



Development Document for the Proposed Effluent Limitations Guidelines and Standards for the Iron and Steel Manufacturing Point Source Category



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**DEVELOPMENT DOCUMENT
FOR PROPOSED EFFLUENT LIMITATIONS
GUIDELINES AND STANDARDS FOR THE
IRON AND STEEL
MANUFACTURING POINT SOURCE CATEGORY**

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SECTION 1

APPLICABILITY AND SUMMARY OF PROPOSED REGULATION

This section presents a brief overview of the Iron and Steel Category, discusses the applicability of the effluent limitations guidelines and standards proposed for the category, and presents the applicability interface between the proposed rule and other regulations for the metals industry. This section also briefly summarizes of the proposed rule and describes the Agency's efforts to protect confidential business information.

1.1 Applicability

The Iron and Steel Category comprises sites that produce raw materials used in ironmaking and steelmaking or produce finished or semifinished steel products. Operations include cokemaking, sintering, ironmaking, steelmaking, ladle metallurgy, vacuum degassing, continuous and ingot casting, hot forming, salt bath and electrolytic descaling, acid pickling, cold forming, alkaline cleaning, hot coating, and electroplating. The proposed rule revises the 1982 technology-based effluent limitations guidelines and standards for wastewater discharges associated with the operation of new and existing facilities within the Iron and Steel Category.

Manufacturing operations that may be subject to the proposed Iron and Steel rule are generally reported under one or more of the following North American Industry Classification System (NAICS) codes (Reference 1-1):

- 324199, Other Petroleum and Coal Products Manufacturing;
- 331111, Iron and Steel Mills;
- 331210, Iron and Steel Pipe and Tube Manufacturing from Purchased Steel;
- 331221, Rolled Steel Shape Manufacturing;
- 332812, Metal coating, engraving (except jewelry and silverware), and allied services to manufacturers; and
- 332813, Electroplating, plating, polishing, anodizing, and coloring.

Specifically, the proposed Iron and Steel effluent limitations guidelines and standards apply to wastewater discharges resulting from the following manufacturing operations:

- By-product recovery and other cokemaking operations manufacturing metallurgical coke (both furnace and foundry coke);

- Sintering, briquetting, and other agglomeration operations conducted by heating iron-bearing materials (e.g., iron ore, mill scale, blast furnace flue dust, blast furnace wastewater treatment sludge), limestone, coke fines, and other materials in a traveling grate combustion system to produce an agglomerate for charging to a blast furnace;
- Ironmaking operations in which iron ore and other iron-bearing materials are reduced to molten iron in a blast furnace;
- Direct reduced ironmaking in which iron pellets are produced through a reaction of iron ore with hot reducing gases;
- Basic oxygen furnace (BOF) steelmaking, ladle metallurgy, vacuum degassing, and continuous casting operations at integrated steel mills. The proposed rule also applies to BOF steelmaking conducted at any location;
- Electric arc furnace (EAF) steelmaking, ladle metallurgy, vacuum degassing, and continuous casting operations conducted at non-integrated steel mills. The proposed rule also applies to EAF steelmaking conducted at any location;
- Primary, section, flat, pipe, and tube hot forming operations conducted at integrated steel mills, non-integrated steel mills, and stand-alone hot forming mills;
- Steel forging operations performed at iron and steel mills; and
- Carbon, alloy, and stainless steel finishing operations, including salt bath and electrolytic sodium sulfate descaling, acid pickling, cold forming, alkaline cleaning, continuous electroplating and hot coating (of flat steel products only), and continuous annealing at integrated, non-integrated, and stand-alone facilities.

1.2 Applicability Interface With Other Regulations

Several existing regulations currently establish effluent limitations guidelines and standards for the metals industry. Regulations covering nonferrous materials, including aluminum forming (40 CFR Part 467), copper forming (40 CFR Part 468), nonferrous metals manufacturing (40 CFR Part 421), and nonferrous metals forming (40 CFR Part 471) do not interface with the effluent limitations guidelines and standards proposed for the Iron and Steel Category. Regulations that cover ferrous materials, however, do interface with the proposed rule for the Iron and Steel Category.

For facilities with process operations in more than one category, National Pollutant Discharge Elimination System (NPDES) permit writers must use a building-block approach to

develop technology-based effluent limitations. Similarly, pretreatment control authorities must use the combined wastestream formula (Reference 1-2) to develop pretreatment requirements for facilities with process operations in more than one category. Permit writers and control authorities should refer to the applicability statements of the regulations for further clarification.

1.2.1 Metal Products and Machinery

Some steel finishing facilities covered by the 1982 Iron and Steel rule perform manufacturing operations such as cold forming, hot coating, and drawing. Some of these operations and associated wastewater discharges closely resemble those covered by the Metal Products and Machinery (MP&M) rule to be proposed at 40 CFR Part 438. Therefore, EPA has determined that some processes regulated under the 1982 Iron and Steel Category would be more appropriately regulated under the proposed MP&M Category.

EPA proposes to regulate the following steel finishing operations under the MP&M Category:

- Batch electroplating of steel;
- Continuous electroplating or hot-dip coating of long steel products (e.g., wire, rod, and bar);
- Cold forming of steel pipe and tube or long steel products;
- Batch hot-dip coating of steel; and
- Drawing and coating of steel wire.

EPA proposes to regulate the following steel finishing operations under the Iron and Steel Category:

- Hot forming of steel pipe and tube;
- Salt bath and electrolytic descaling, acid pickling, and alkaline cleaning of flat steel products (e.g., plate, sheet, and strip);
- Cold forming of flat steel products;
- Finishing with continuous electroplating of flat steel products; and
- Continuous hot-dip coating of flat steel products.

The proposed Iron and Steel Category covers hot forming operations on steel pipe and tube; the proposed MP&M Category does not cover these operations. The proposed Iron and Steel Category covers salt bath and electrolytic descaling operations, acid pickling, alkaline

cleaning operations, cold forming operations, finishing with continuous electroplating operations, and continuous hot coating operations on flat steel products because these operations are common to a relatively large number of integrated and non-integrated iron and steel mills. Because EPA is proposing to regulate these operations at integrated and non-integrated iron and steel mills, the Agency is also proposing to regulate these operations at stand-alone steel finishing mills.

1.2.2 Electroplating

Facilities that are covered by the Electroplating Category and discharge to a publicly owned treatment works (POTW) are regulated under 40 CFR Part 413. This category comprises indirect discharging job shop electroplaters and independent printed circuit board manufacturers that were in operation prior to July 15, 1983. The electroplating rule specifically excludes continuous strip electroplating operations conducted at indirect discharging iron and steel facilities; therefore, the electroplating rule does not overlap with the proposed Iron and Steel rule.

1.2.3 Metal Finishing

Wastewater discharges from facilities within the Metal Finishing Category are regulated under 40 CFR Part 433. This category comprises facilities that perform any of the following six metal finishing operations on any basis material: electroplating, electroless plating, anodizing, coating (chromating, phosphating, and coloring), chemical etching and milling, and printed circuit board manufacturing. The Metal Finishing rule establishes effluent limitations guidelines and standards for 40 surface treatment operations at facilities within this category.

Electroplating operations at iron and steel mills are currently regulated under the Metal Finishing Category; however, the Agency proposes to regulate the continuous electroplating of flat steel products under the Iron and Steel Category because this process is common to a relatively large number of integrated and non-integrated steel mills. Iron and steel facilities successfully and cost-effectively co-treat wastewater discharges from continuous strip electroplating operations and other steel finishing operations.

The proposed change in electroplating applicability will assist NPDES permit writers and pretreatment control authorities. Currently, permit writers and control authorities are required to combine production-based and concentration-based limitations and standards when permitting iron and steel mills with electroplating operations because effluent limitations guidelines and standards are production-based under the Iron and Steel Category and concentration-based under the Metal Finishing Category. To provide consistency, the electroplating limitations and standards in the proposed Iron and Steel rule are production-based.

1.2.4 Coil Coating

Wastewater discharges from facilities within the Coil Coating Category are regulated under 40 CFR Part 465. Coil coating facilities typically clean, conversion coat, and apply organic polymeric materials (such as paint) to continuous strips of metal coil (typically steel, galvanized metal, or aluminum). The Coil Coating Category comprises facilities that perform at least two of these three operations. The proposed Iron and Steel rule is not intended to regulate mild acid or mild alkaline cleaning operations conducted at coil coating facilities, nor is it intended to regulate conversion coating or the application of organic polymeric material to steel; therefore, the proposed Iron and Steel rule does not overlap with the Coil Coating rule.

1.2.5 Ferroalloy Manufacturing

Wastewater discharges from facilities within the Ferroalloy Manufacturing Category are regulated under 40 CFR Part 424. This category comprises facilities that smelt ferroalloys in electric furnaces or other devices with wet air pollution control, recover and process furnace slag, produce calcium carbide in covered electric furnaces with and without wet air pollution control, and manufacture electrolytic manganese products and electrolytic chromium products. A ferroalloy is an iron-bearing product, not within the range of those products called steel, which contains a considerable amount of one or more alloying elements, such as manganese, silicon, phosphorus, vanadium, and chromium. The Iron and Steel Category does not cover any ferroalloy manufacturing operations.

1.2.6 Metal Molding and Casting

Wastewater discharges from facilities within the Metal Molding and Casting Category are regulated under 40 CFR Part 464. This category comprises facilities that remelt, mold, and cast aluminum, copper, zinc, and ferrous metals and alloys into intermediate or finished products. The proposed Iron and Steel rule does not overlap with the Metal Molding and Casting rule because the proposed rule applies only to those facilities that cast molten steel produced in BOF and EAF steelmaking furnaces after any ladle metallurgy and vacuum degassing operations.

1.3 Summary of Proposed Regulation

The proposed Iron and Steel rule revises the technology-based effluent limitations guidelines and standards at 40 CFR Part 420 for wastewater discharges associated with the operation of new and existing facilities within the Iron and Steel Category. The proposed rule includes the following features:

- EPA is proposing new effluent limitations guidelines and standards for BAT, NSPS, PSES, and PSNS under a revised subcategory structure for the industry. The Agency does not propose to revise BCT. (See Section 2.1.1 for a discussion of these terms.) The revised subcategory structure does the following:

- Removes defunct manufacturing processes;
 - Eliminates manufacturing processes in the hot forming and finishing subcategories;
 - Creates a new subcategory for non-integrated steelmaking and hot forming processes; and
 - Creates new subcategories and segments for manufacturing processes not regulated under the 1982 rule, including continuous electroplating of flat steel products, direct reduced ironmaking, briquetting, and steel forging.
- The Agency is proposing BPT limitations for direct reduced ironmaking and forging, but proposes to leave the 1982 production-based BPT effluent limitations in place (see Section 2.1.1 for a discussion of BPT). The Agency is considering converting the existing production-based BPT limitations for total suspended solids and oil and grease to concentration-based limitations based on the production-normalized flows used to develop the limitations in the 1982 regulation.
 - EPA is proposing two different BAT approaches for the Carbon and Alloy Steel Segment of the Integrated and Stand-Alone Hot Forming Subcategory. The options differ in the amount of time that facilities in the segment would have to achieve BAT limitations. Under one option, a facility would be subject to BAT limitations as soon as these limitations are placed in the NPDES permit. Under the other option, a facility could obtain additional time to achieve BAT limitations.
 - The Agency is proposing zero discharge as NSPS for the non-integrated steelmaking and hot forming subcategory.
 - EPA is considering defining a reasonable measure of actual production for calculating NPDES and pretreatment permit production rates. The Agency is considering the following alternatives:
 - Retaining the essential requirements of the 1982 rule while providing additional instruction for avoiding unrealistically high estimates of actual production;
 - Requiring the permit writer to establish multitiered permit limits;
 - Revising the definition of production to be the average daily operating rate for the year with the highest annual production over the past five years; or

- Establishing production-based maximum monthly average effluent limitations and standards in combination with daily maximum concentration-based effluent limitations and standards.
- EPA is proposing to regulate mercury and selenium based on toxicity and presence in cokemaking wastewater.
- EPA is proposing to regulate 2,3,7,8-tetrachlorodibenzofuran (2,3,7,8-TCDF) in sinter plant wastewater and require compliance monitoring either after the primary treatment of sinter plant wastewater or after sinter plant and blast furnace wastewater discharges are co-treated, but before sinter plant wastewater is combined with any other process or nonprocess discharges. The Agency is considering limiting dioxins and furans in sinter plant wastewater on the basis of 2,3,7,8-TCDD toxicity equivalents, which would measure all of the 17 dioxin and furan congeners with chlorine substitutions at the 2,3,7 and 8 lateral positions. This approach is consistent with the international toxicity equivalents factors approach, EPA's approach to regulating dioxins in other media and conducting risk assessments, and EPA's source characterization work to assess the national inventory of dioxin releases to the environment.
- EPA is considering developing a limit, based on acid purification technology or product substitution, for nitrate/nitrite (in the form of nitrate-nitrite-N) for stainless steel finishing operations with nitric acid and combination acid pickling.
- EPA is considering waiving the pretreatment standards for ammonia as nitrogen for blast furnace wastewater indirectly discharged to POTWs that have the capability to conduct nitrification.
- Similar to the 1982 rule, the proposed rule expresses effluent limitations guidelines and standards for wet air pollution control devices at steel finishing operations in mass of pollutant per day. The proposed rule expresses all other proposed effluent limitations guidelines and standards within the Iron and Steel Category in mass of pollutant per mass of production.
- The proposed rule revises the units of pollutant limitations from kilograms of allowable pollutant discharge per thousand kilograms of production (kg/kg), also expressed as pounds of allowable pollutant discharge per thousand pounds of production (lbs/1,000 lbs), to pounds of allowable pollutant discharge per ton of production (lbs/ton). The Agency made this change to express effluent limitations in terms of the production value that is standard throughout the industry.

- The proposed rule makes the following revisions to the 1982 “Water Bubble” provision:
 - Allows trades for cold rolling operations;
 - Allows trades for cokemaking operations only when more stringent limits result;
 - Prohibits trades for sintering operations when less stringent limits result; and
 - Prohibits trades for oil and grease.
- While the 1982 regulation often requires permit writers and control authorities to apply pH limitations at internal discharge monitoring locations, prior to additional treatment or mixing with other wastewater discharges, the proposed rule allows permit writers and control authorities to establish pH effluent limitations at final outfalls such that redundant and unnecessary pH neutralization can be avoided.

1.4 Protection of Confidential Business Information

EPA recognizes that certain data in the proposed rulemaking record have been claimed as confidential business information (CBI). The Agency has removed CBI from the public record in the Water Docket. In addition, the Agency has withheld from disclosure some data not claimed as CBI because the release of these data could indirectly reveal CBI. Furthermore, EPA has aggregated certain data in the public record, masked facility identities, or used other strategies to prevent the disclosure of CBI. The Agency’s approach to CBI protection ensures that the data in the public record both explain the basis for the proposed rule and provide the opportunity for public comment, without compromising data confidentiality.

1.5 References

- 1-1 North American Industry Classification System, U.S. Office of Management and Budget. Washington, D.C., 1997.
- 1-2 U.S. Environmental Protection Agency. Guidance Manual for the Use of Production-Based Pretreatment Standards and the Combined Wastestream Formula. Washington, D.C., September 1985.

SECTION 2

BACKGROUND

This section provides background information on the development of revised effluent limitations guidelines and standards proposed for the Iron and Steel Category. Sections 2.1 and 2.2 discuss the legal authority and legislative background for the proposed rule. Section 2.3 presents a history of Iron and Steel Category rulemaking activities.

2.1 Legal Authority

EPA is proposing revised effluent limitations guidelines and standards for the Iron and Steel Category under the authority of Sections 301, 304, 306, 307, 308, 402, and 501 of the Clean Water Act, 33 U.S.C. 1311, 1314, 1316, 1317, 1318, 1342, and 1361.

2.1.1 Legislative Background

Congress adopted the Clean Water Act (CWA) to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” (Section 101(a), 33 U.S.C. 1251(a)). To achieve this goal, the CWA prohibits the discharge of pollutants into navigable waters, except in compliance with the statute. The CWA confronts the problem of water pollution on a number of different fronts; however, it relies primarily on establishing restrictions on the types and amounts of pollutants discharged from various industrial, commercial, and public sources of wastewater.

Congress recognized that regulating only those sources that discharge effluent directly into the nation’s waters would not be sufficient to achieve the goals of the CWA. Consequently, the CWA requires EPA to promulgate nationally applicable pretreatment standards that restrict pollutant discharges for those sources that discharge wastewater indirectly through sewers flowing to publicly owned treatment works (POTWs) (Section 307(b) and (c), 33 U.S.C. 1317(b) and (c)). National pretreatment standards apply to wastewater pollutants that may pass through or interfere with POTW operations. Generally, pretreatment standards are designed to ensure that wastewater streams from indirect industrial dischargers are subject to similar levels of treatment as direct industrial dischargers. In addition, POTWs must develop and enforce local treatment limits applicable to their industrial indirect dischargers when necessary to prevent pass-through and/or interference (40 CFR 403.5).

Direct dischargers must comply with effluent limitations in National Pollutant Discharge Elimination System (NPDES) permits; indirect dischargers must comply with pretreatment standards. These limitations and standards are established by regulation for categories of industrial dischargers and are based on the degree of control that can be achieved using various levels of pollution control technology.

**Best Practicable Control Technology Currently Available (BPT) –
Section 304(b)(1) of the CWA**

EPA defines BPT effluent limitations for conventional, nonconventional, and priority¹ pollutants. In specifying BPT, EPA looks at a number of factors. EPA first considers the cost of achieving effluent reductions in relation to the effluent reduction benefits. The Agency also considers the age of equipment and facilities, the processes employed and any required process changes, engineering aspects of the control technologies, non-water quality environmental impacts (including energy requirements), and other factors the Agency deems appropriate (CWA 304(b)(1)(B)). Traditionally, EPA establishes BPT effluent limitations based on the average of the best performances of facilities within the industry, grouped to reflect various ages, sizes, processes, or other common characteristics. Where existing performance is uniformly inadequate, however, EPA may establish limitations based on higher levels of control than currently in place in an industrial category if the Agency determines that the technology is available in another category or subcategory and can be practically applied.

**Best Conventional Pollutant Control Technology (BCT) –
Section 304(b)(4) of the CWA**

The 1977 amendments to the CWA required EPA to identify effluent reduction levels for conventional pollutants associated with BCT technology for discharges from existing industrial point sources. In addition to other factors specified in Section 304(b)(4)(B), the CWA required that EPA establish BCT limitations after consideration of a two-part “cost reasonableness” test. EPA explained its methodology for the development of BCT limitations in July 1986 (51 FR 24974).

Section 304(a)(4) designates the following as conventional pollutants: biochemical oxygen demand, total suspended solids, fecal coliform, pH, and any additional pollutants defined by the Administrator as conventional. The Administrator designated oil and grease as an additional conventional pollutant on July 30, 1979 (44 FR 44501).

**Best Available Technology Economically Achievable (BAT) –
Section 304(b)(2) of the CWA**

In general, BAT effluent limitations guidelines represent the best economically achievable performance of facilities in the industrial subcategory or category. EPA considers the following factors in assessing BAT: the cost of achieving BAT effluent reductions, the age of

¹In the initial stages of the CWA regulation, EPA efforts emphasized the achievement of BPT limitations for control of the conventional pollutants (e.g., total suspended solids, pH, and biochemical oxygen demand). However, nothing on the face of the statute explicitly restricted BPT limitations to such pollutants. Following passage of the CWA of 1977, with its requirement for point sources to achieve best available technology limitations to control discharges of toxic pollutants, EPA shifted the focus of the effluent limitations guidelines program to address the listed priority pollutants. BPT guidelines may continue to include effluent limitations to address all pollutants.

equipment and facilities involved, the processes employed, potential process changes, and non-water quality environmental impacts, including energy requirements. The Agency retains considerable discretion in assigning the weights of these factors. Unlike BPT limitations, BAT limitations may be based on effluent reductions attainable through changes in a facility's processes and operations. As with BPT, where existing performance in a category or subcategory is uniformly inadequate, BAT may require a higher level of performance than is currently being achieved based on technology transferred from a different category or subcategory. BAT may be based upon process changes or internal controls, even when these technologies are not common industry practice.

New Source Performance Standards (NSPS) – Section 306 of the CWA

NSPS reflect effluent reductions that are achievable based on the best available demonstrated control technology. New facilities have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent controls attainable through the application of the best available control technology for all pollutants (that is, conventional, nonconventional, and priority pollutants). In establishing NSPS, EPA must take into consideration the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements.

Pretreatment Standards for Existing Sources (PSES) – Section 307(b) of the CWA

PSES are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. The CWA authorizes EPA to establish pretreatment standards for pollutants that pass through POTWs or interfere with treatment processes or sludge disposal methods at POTWs. Pretreatment standards are technology-based and analogous to BAT effluent limitations guidelines.

The General Pretreatment Regulations, which set forth the framework for the implementation of categorical pretreatment standards, are found at 40 CFR Part 403. Those regulations contain a definition of pass-through that addresses local rather than national instances of pass-through and establishes pretreatment standards that apply to all nondomestic dischargers (52 FR 1586, January 14, 1987).

Pretreatment Standards for New Sources (PSNS) – Section 307(c) of the CWA

Like PSES, PSNS are designed to prevent the discharges of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. PSNS are to be issued at the same time as NSPS. New indirect dischargers have the opportunity to incorporate into their facilities the best available demonstrated technologies. The Agency considers the same factors in promulgating PSNS as it considers in promulgating NSPS.

2.1.2 Section 304(m) Requirements and Litigation

Section 304(m) of the CWA, added by the Water Quality Act of 1987, requires EPA to establish schedules for: (1) reviewing and revising existing effluent limitations guidelines and standards; and (2) promulgating new effluent limitations guidelines and standards. On January 2, 1990, EPA published an Effluent Guidelines Plan (55 FR 80) that established schedules for developing new and revised effluent limitations guidelines and standards for several industry categories, one of which was the Iron and Steel Category.

The Natural Resources Defense Council (NRDC) and Public Citizen, Inc. filed suit against the Agency, alleging violation of Section 304(m) and other statutory authorities requiring promulgation of effluent limitations guidelines and standards. See *NRDC et al. v. Browner*, Civ. No. 89-2980 (D.D.C.). Under the terms of a consent decree dated January 31, 1992, which settled the litigation, EPA agreed, among other things, to conduct a study of the iron and steel industry. The Agency completed this study, discussed in Section 2.2.3 of this document, in 1995. After the study, the Agency named the Iron and Steel rule as one of the new or revised rules to be developed under the terms of the consent decree. On November 18, 1998, the court approved modifications to the consent decree to revise the deadline for the Iron and Steel rule to October 2000 for proposal and April 2002 for final action. EPA provided notice of these modifications on March 30, 1999 (64 FR 15158).

2.2 History of Iron and Steel Category Rulemaking Activities

This subsection presents a brief history of Iron and Steel Category rulemaking activities. Section 2.2.1 discusses prior Iron and Steel Category wastewater discharge regulations. Section 2.2.2 discusses the 1982 Iron and Steel rule. Section 2.2.3 discusses the Preliminary Study of the Iron and Steel Category.

2.2.1 Prior Regulations

On June 28, 1974, EPA promulgated effluent limitations for BPT and BAT, NSPS, and PSNS for basic steelmaking operations (Phase I) of the integrated steel industry (39 FR 24114-24133, 40 CFR Part 420, Subparts A-L). The regulation covered the following 12 subcategories of the industry:

- By-product cokemaking;
- Beehive cokemaking;
- Sintering;
- Blast furnace (iron);
- Blast furnace (ferromanganese);
- Basic oxygen furnace (semi-wet air pollution control methods);
- Basic oxygen furnace (wet air pollution control methods);
- Open hearth furnace;
- Electric arc furnace (semi-wet air pollution control methods);
- Electric arc furnace (wet air pollution control methods);

- Vacuum degassing; and
- Continuous casting and pressure slab molding.

In response to several petitions for review, the United States Court of Appeals for the Third Circuit remanded portions of that regulation on November 7, 1975. See American Iron & Steel Inst., et al. v. EPA, 526 F.2d 1027 (3d Cir. 1975). While the court rejected all technical challenges to the BPT limitations, it held that the BAT effluent limitations and NSPS for certain subcategories were “not demonstrated.” In addition, the court ruled that EPA had not adequately considered the impact of plant age on the cost or feasibility of retrofitting pollution controls, had failed to assess the impact of the regulation on water scarcity in arid and semi-arid regions of the country, and had failed to make adequate “net/gross” provisions for pollutants found in intake water supplies.

On March 29, 1976, EPA promulgated BPT and BAT effluent limitations, NSPS, and PSNS for steel forming and finishing operations (Phase II) within the steel industry (41 FR 12990-13030, 40 CFR Part 420, Subparts M-Z). The regulation covered the following 14 subcategories of the industry:

- Hot forming - primary;
- Hot forming - section;
- Hot forming - flat;
- Pipe and tube;
- Pickling - sulfuric acid - batch and continuous;
- Pickling - hydrochloric acid - batch and continuous;
- Cold rolling;
- Hot coating - galvanizing;
- Hot coating - terne;
- Miscellaneous runoff - storage piles, casting, and slagging;
- Combination acid picking - batch and continuous;
- Scale removal - Kolene and Hydride;
- Wire pickling and coating; and
- Continuous alkaline cleaning.

The U.S. Court of Appeals for the Third Circuit remanded portions of that regulation on September 14, 1977. See American Iron & Steel Inst., et al. v. EPA, 568 F.2d 284 (3d Cir. 1977). The court again rejected all technical challenges to the BPT limitations, though it ruled that EPA had not adequately considered age/retrofit and water scarcity issues for BAT. In addition, the court invalidated the regulation as it applied to the specialty steel industry for lack of proper notice. The court also directed EPA to reevaluate its cost estimates in light of “site-specific costs” and to reexamine its economic impact analysis for BAT. The court also held that the Agency had no statutory authority to exempt plants in the Mahoning Valley region of Eastern Ohio from compliance with the BPT limitations for the Iron and Steel Category.

On January 28, 1981, the Agency promulgated General Pretreatment Regulations applicable to existing and new indirect dischargers within the iron and steel industry and other major industries (40 CFR Part 403, 47 FR 4518).

2.2.2 1982 Regulation

On May 27, 1982, EPA promulgated effluent limitations for BPT, BAT, BCT, and NSPS, PSES, and PSNS for the Iron and Steel Category (47 FR 23258, 40 CFR Part 420). The regulation covered the following 12 subcategories of the industry:

- Cokemaking;
- Sintering;
- Ironmaking;
- Steelmaking;
- Vacuum degassing;
- Continuous casting;
- Hot forming;
- Salt bath descaling;
- Acid pickling;
- Cold forming;
- Alkaline cleaning; and
- Hot coating.

The 1982 regulation was the first promulgated by EPA under the 1977 amendments to the CWA, and, thus, was the first to distinguish between conventional, nonconventional, and priority pollutants in the regulatory scheme established by the 1977 amendments.

The American Iron and Steel Institute, certain members of the iron and steel industry, and the NRDC filed petitions to review the 1982 regulation. Their challenges were consolidated into one lawsuit by the Third Circuit Court of Appeals. See National Steel Corp. v. EPA, No. 82-3225 and Consolidated Cases. On February 4, 1983, the parties in the consolidated lawsuit entered into a comprehensive settlement agreement that resolved all issues raised by the petitioners. In accordance with the settlement agreement, EPA modified and clarified certain parts of the Iron and Steel rule and published additional preamble language regarding the rule.² EPA published the amended Iron and Steel rule on May 17, 1984 (49 FR 21024). Some of the modifications made to the rule include the following:

- EPA included a method for calculating production-based pretreatment standards. This method largely mirrored the method given at 40 CFR

²EPA also agreed to take final action on an amendment to the General Pretreatment Regulations (40 CFR Part 403) to permit the reclassification of noncontact cooling water flows contaminated with significant quantities of pollutants from “dilute” to “unregulated” for purposes of the combined wastestream formula at 40 CFR 403.6 (e).

122.45(b)(2) for calculating production-based effluent limitations for direct dischargers.

- While the “Water Bubble” provision (40 CFR 420.03) in the 1982 rule originally provided that the alternative effluent limitations established under the provision must result in *no increase* in the discharge of pollutants beyond that allowed by the generally applicable limitations, the amended provision provided that alternative effluent limitations must result in a specified *decrease* in the discharge of traded pollutants from the amount allowed by the generally applicable limitations.
- EPA included a provision at 40 CFR Part 420.06 to grant removal credits for total phenols when used as an indicator or surrogate pollutant.
- EPA raised BAT effluent limitations and NSPS, PSES, and PSNS for lead and zinc in the ironmaking and sintering subcategories.
- EPA modified BAT effluent limitations and PSES for total cyanide and established a new segment for existing indirect blast furnace dischargers. The new segment contained standards identical to the generally applicable PSES, except that the promulgated ammonia-N and total phenols standards were less stringent.
- EPA raised BPT and BAT effluent limitations and NSPS, PSES, and PSNS for zinc in the sulfuric and hydrochloric acid pickling segments of the acid pickling subcategory.
- While the 1982 regulation originally limited all cold worked pipe and tube operations to zero discharge for BPT, BAT, and BCT effluent limitations and NSPS, PSES, and PSNS, the amended rule permitted nominal discharges (rather than contract hauling) of spent oil or water solution and specified that limitations and standards for types of process wastewater not covered under the 1982 regulation were to be developed on a case-by-case basis.
- EPA modified effluent limitations and standards for zinc under the hot coating subcategory, provided that facilities achieving zinc discharge levels more stringent than the amended limitations and standards continued to do so. The amended rule also provided that the modified limitations for the hot coating subcategory could be used as a basis for determining alternative limitations under the “Water Bubble” provision, even for those facilities achieving discharge levels more stringent than the amended limitations and standards.

EPA based the pretreatment standards in the 1982 rule upon a reasonable measure of actual production, such as the production during the high month of the previous year or the monthly average for the highest of the previous five years (40 CFR 420.04).

Under the “Water Bubble” provision in the 1982 rule, any facility within the Iron and Steel Category may qualify for alternative effluent limitations for a number of processes representing the degree of effluent reduction attainable by the application of BPT, BAT, and BCT. The alternative effluent limitations for each pollutant are determined for a combination of outfalls by totaling the mass limitations of each pollutant allowed under the rule and subtracting from each total an appropriate net reduction amount. Permit writers may determine appropriate net reduction amounts based on additional available control measures that would substantially reduce the effluent without requiring significant additional expenditures. The 1982 provision prohibits alternative effluent limitations for the cokemaking and cold forming subcategories.

The “Central Treatment Facilities” provision in the 1982 rule temporarily excluded 21 facilities due to economic considerations, provided the owner(s) or operator(s) of the facilities requested that the Agency consider establishing alternative effluent limitations and supplied EPA with information consistent with 40 CFR 420.01(b)) on or before July 26, 1982.³

2.2.3 Preliminary Study of the Iron and Steel Category

Under the terms of the 1992 consent decree with the NRDC, EPA must initiate preliminary reviews of a number of categorical effluent limitations guidelines and standards on a set schedule. Pursuant to these legislative and judicial requirements, EPA published the Preliminary Study of the Iron and Steel Category (EPA 821-R-95-037) in September 1995. The study includes the following:

- A preliminary assessment of the status of the industry with respect to the Iron and Steel rule promulgated in 1982 and amended in 1984;
- Identification of better-performing mills using conventional and innovative in-process pollution prevention and end-of-pipe treatment technologies;
- Estimation of possible effluent reduction benefits if the industry was upgraded to the level of better-performing mills; and
- Identification of regulatory and implementation issues with the Iron and Steel rule and possible solutions to these issues.

³Currently, each of these 21 facilities has a permit with effluent limitations derived from Part 420. The proposed rule establishes new BAT limitations that EPA believes are economically achievable for all iron and steel subcategories. Therefore, EPA believes that provisions for alternative effluent limitations are no longer necessary for these facilities and proposes to withdraw this exclusion from Part 420.

The study found that the iron and steel industry had restructured during the decade following the 1984 amendments to the Iron and Steel rule. The study found that the industry had improved manufacturing techniques, water conservation, pollution prevention, and wastewater treatment practices. The study also found that the industry had consolidated and modernized in response to domestic and world competition. While the market for integrated mills continued to decrease, the market for non-integrated mills using steel scrap as their primary material continued to expand due to improvements in the quality of steel manufactured from scrap. Cokemaking was declining due to changes in ironmaking processes, while direct reduced ironmaking was increasing. Also, continuous casting became the new industry standard due to the increased energy efficiency of the process compared with ingot casting.

Overall, the study found that the industry was operating with greater efficiency. Pollutant loadings had decreased due to increased wastewater recycle rates on manufacturing processes and improved wastewater treatment processes. At the time of the study, many better-performing mills were discharging wastewater loadings far below the limitations and standards established in the 1982 rule; however, not all of the industry had improved wastewater treatment or implemented proactive pollution prevention practices. At the time of the study, discharges from some mills continued to exceed allowances specified in the 1982 rule.

SECTION 3

DATA COLLECTION

EPA gathered and evaluated information and data from various sources in the course of developing the proposed effluent limitations guidelines and standards for the iron and steel industry. EPA used these data to develop the industry profile, to determine the applicability of the rule, to subcategorize the industry, and to determine wastewater characteristics, technology options, compliance costs, pollutant loading reductions, and non-water quality impacts. This section discusses the following data collection activities:

- Surveys, including descriptions of the survey instruments and determination of survey recipients (Section 3.1);
- Site visits, including descriptions of the types of sites visited, the geographical locations, and the manufacturing processes at the sites visited (Section 3.2);
- Sampling episodes, including the types of sites sampled, the manufacturing processes and treatment systems sampled, and the sampling process (Section 3.3);
- Other data sources (Section 3.4); and
- Public participation, including meetings with stakeholders from industry trade associations, individual steel companies, environmental groups, and nongovernmental organizations (Section 3.5).

3.1 Surveys

The principal source of information and data used in developing effluent limitations guidelines and standards is the industry response to surveys distributed by EPA under the authority of Section 308 of the Clean Water Act. EPA designed these surveys to obtain information concerning manufacturing operations, wastewater generation and treatment, discharge practices, and analytical data. The Agency developed related surveys to obtain financial data for use in assessing economic impacts and the economic achievability of technology options.

EPA developed an Information Collection Request (ICR) entitled U.S. Environmental Protection Agency Collection of 1997 Iron and Steel Industry Data that explains the regulatory basis and intended use of the industry surveys. The Office of Management and Budget (OMB) approved the ICR in August 1998 (OMB Control No. 2040-0193, approval expires 08/31/2001) (Reference 3-1). The Agency published three Federal Register notices announcing: (1) the intent to distribute the surveys (62 FR 54453; October 20, 1997), (2) the submission of the ICR to the OMB (63 FR 16500; April 3, 1998), and (3) OMB's approval of the ICR (63 FR 47023; September 3, 1998) (References 3-2 through 3-4). The Agency consulted

with industry trade associations and visited a number of sites to develop survey instruments and to ensure an accurate mailing list.

EPA distributed four industry surveys. The first two surveys were similar in content and purpose, designed to collect detailed technical and financial information from iron and steel facilities. In October 1998, EPA mailed the first survey, entitled U.S. EPA Collection of 1997 Iron and Steel Industry Data (detailed survey), to 176 iron and steel industry sites and the second survey, entitled U.S. EPA Collection of 1997 Iron and Steel Industry Data (Short Form) (short survey), to 223 iron and steel industry sites. The short survey is an abbreviated version of the detailed survey and was designed for those iron and steel industry sites that do not have manufacturing processes found only at integrated and non-integrated mills (the cokemaking, ironmaking, and steelmaking processes described in Section 5). Section 5 describes the types of sites that received a detailed or short survey. EPA mailed the third and fourth surveys to subsets of the facilities that received the first or second survey to obtain more detailed information on wastewater treatment system costs, analytical data, and facility production. EPA mailed the third survey, entitled U.S. EPA Collection of Iron and Steel Industry Wastewater Treatment Capital Cost Data (cost survey), to 90 iron and steel industry sites. EPA mailed the fourth survey, entitled U.S. EPA Analytical and Production Data Follow-Up to the Collection of 1997 Iron and Steel Industry Data (analytical and production survey), to 38 iron and steel industry sites.

The detailed and short survey were divided into two parts: Part A: Technical Information and Part B: Financial and Economic Information. The “Part A” technical questions in the detailed survey comprised four sections, with Sections 3 and 4 being combined in the short survey, as follows:

- Section 1: General Site Information;
- Section 2: Manufacturing Process Information;
- Section 3: In-Process and End-of-Pipe Wastewater Treatment and Pollution Prevention Information; and
- Section 4: Wastewater Outfall Information.

The financial and economic information in Part B of the detailed survey also comprised four sections, as shown below:

- Section 1: Site Identification;
- Section 2: Site Financial Information;
- Section 3: Business Entity Financial Information; and
- Section 4: Corporate Parent Financial Information.

Part B of the short survey contained a single section for site identification and financial information. More detailed descriptions of financial information data collection and analysis are included in the Economic Analysis of the Proposed Effluent Limitations Guidelines and Standards for the Iron and Steel Manufacturing Point Source Category (Reference 3-5).

The detailed survey requested detailed descriptions of all manufacturing processes and treatment systems that EPA determined were included in the iron and steel industry. The short survey contained manufacturing process questions for only forming and finishing operations. EPA eliminated the cokemaking, ironmaking, and steelmaking questions from the short survey because they were not applicable to the types of facilities that received the short survey. The Agency also reduced the amount of detail requested in the short survey. EPA determined that if, for example, it received detailed descriptions of hot forming mills from an adequate number of integrated, non-integrated, and stand-alone hot forming mills to understand the different processes, then it could make assumptions about industry trends from the reduced detail collected in the short survey.

Part A Section 1 requested site contacts and addresses and general information regarding manufacturing operations, age, and location. The Agency used this information to develop the subcategorization for the proposed regulation.

Part A Section 2 requested information on products, types of steel produced, production levels, unit operations, chemicals and coatings used, quantity of wastewater discharged from unit operations, miscellaneous wastewater sources, flow rates, pollution prevention activities, and air pollution control. The Agency used data received in response to these questions to evaluate manufacturing processes and wastewater generation, and to develop regulatory options. EPA also used these data to develop the proposed subcategorization and to estimate compliance costs and pollutant removals associated with the regulatory options EPA considered for proposal.

Part A Section 3 requested detailed information (including diagrams) on the wastewater treatment systems and discharge flow rates, monitoring analytical data, and operating and maintenance cost data (including treatment chemical usage). The Agency used data received in response to these questions to identify treatment technologies in place, to determine the feasibility of regulatory options, and to estimate compliance costs and pollutant removals associated with the proposed regulatory options.

Part A Section 4 requested permit information, discharge location, wastewater sources to each outfall, flow rates, regulated pollutants and limits, and permit monitoring data. The Agency used this information to calculate the effluent limitations guidelines and standards and pollutant loadings associated with the proposed regulatory options.

The cost survey requested detailed capital cost data on selected wastewater treatment systems installed since 1993, including equipment, engineering design, and installation costs. EPA incorporated these data into a costing methodology and used them to determine

incremental investment costs and incremental operating and maintenance costs associated with the proposed regulatory options.

The analytical and production survey requested detailed daily analytical and flow rate data for selected sampling points and monthly production data and operating hours for selected manufacturing operations. The Agency used the analytical data to estimate baseline pollutant loadings and pollutant removals from facilities with treatment in place similar to the proposed options and to evaluate the variability associated with iron and steel industry discharges. The Agency used the production data collected to evaluate the production basis for applying the proposed rule in National Pollutant Discharge Elimination System (NPDES) permits and pretreatment permits.

EPA sent the iron and steel industry surveys by mail to facilities that were identified from the following sources:

- Association of Iron and Steel Engineers' 1997 Directory: Iron and Steel Plants Volume 1, Plants and Facilities (Reference 3-6);
- Iron and Steel Works of the World (12th edition) directory (Reference 3-7);
- Iron and Steel Society's Steel Industry of Canada, Mexico, and the United States: Plant Locations map (Reference 3-8);
- Member lists from the following trade associations:
 - American Coke and Coal Chemicals Institute (Reference 3-9),
 - American Galvanizers Association (Reference 3-10),
 - American Iron and Steel Institute (Reference 3-11),
 - American Wire Producers Association (Reference 3-12),
 - Cold Finished Steel Bar Institute (Reference 3-13),
 - Specialty Steel Industry of North America (Reference 3-14),
 - Steel Manufacturers Association (Reference 3-15),
 - Steel Tube Industry of North America (Reference 3-16), and
 - Wire Association International (Reference 3-17);
- Dun & Bradstreet Facility Index database (Reference 3-18);
- EPA Permit Compliance System (PCS) database (Reference 3-19);
- EPA Toxic Release Inventory (TRI) database (Reference 3-20);
- Iron and Steelmaker Journal "Roundup" editions (Reference 3-21);
- 33 Metalproducing Journal "Roundup" editions (Reference 3-22);

- 33 Metalproducing Journal “Census of the North American Steel Industry” (Reference 3-23); and
- Thomas Register (Reference 3-24).

The Agency cross-referenced these sources with one another to develop a list of individual sites. Based on these sources, EPA identified 822 candidate facilities to receive surveys. These candidates include facilities that EPA now proposes to include in the Metal Products and Machinery (MP&M) Category and will be regulated under 40 CFR Part 438. To minimize the burden on the respondents, EPA grouped them into 12 strata. In general, EPA determined the strata based on its understanding of the manufacturing processes at each facility. The Agency also developed two “certainty strata,” one for the detailed survey and one for the short survey. Table 3-1 presents the stratification of the iron and steel industry.

Depending on the amount or type of information EPA required for the rulemaking, EPA either solicited information from all facilities within a stratum (i.e., performed a census) or selected a random sample of facilities within each stratum. EPA sent a survey to all facilities in the certainty strata (strata 5 and 8) because the Agency determined it was necessary to capture the size, complexity, or uniqueness of the steel operations present at these sites. EPA also sent surveys to all facilities in strata 1 through 4 (all cokemaking sites, integrated steel sites, and sintering and direct reduced iron sites) because the number of sites in each stratum is relatively low and because of the size, complexity, and uniqueness of raw material preparation and steel manufacturing operations present. The Agency statistically sampled the remaining sites in strata 6, 7, and 9 through 12. EPA gave survey weights to each selected facility based on a facility’s probability of selection. If the Agency sent a survey to every facility in a stratum, each facility represents only itself. For statistically sampled strata, each facility was given a survey weight that allows it to represent itself and other facilities within that stratum that were not selected to receive an industry survey. See Appendix A for more details.

Of the 822 candidate facilities, EPA mailed either a detailed survey or a short survey to 399 facilities. Detailed survey recipients included integrated mills, non-integrated mills, stand-alone cokemaking sites, stand-alone sintering sites, stand-alone direct reduced ironmaking sites, stand-alone hot forming sites, and stand-alone finishing sites. Short survey recipients included stand-alone cold forming sites, stand-alone pipe and tube sites, stand-alone hot dip coating sites, and stand-alone wire sites. Section 5 describes these types of sites. Eleven sites receiving a survey did not return a completed survey and, thus, are considered non-respondents. EPA did not consider 10 sites receiving surveys for further review: seven of these sites were closed, two sites were considered part of another site owned by the same company, and one site received two surveys under two mailing addresses and, therefore, only one survey was completed. EPA received 378 completed surveys, including those from 33 sites that certified that they were not engaged in iron and steel activities.

One hundred fifty-four of the returned surveys were from sites with operations that were later determined to be within the scope of the MP&M Category. Similarly, two recipients of MP&M surveys were determined to be within the scope of the Iron and Steel Category.

Therefore, the Agency used the data from 191 returned surveys and the two MP&M industry surveys in the development of the proposed rule.

Once the Agency completed a review of the detailed and short surveys and defined the treatment technology options, EPA identified survey respondents who had installed wastewater treatment systems in the last 10 years (since 1990) that were similar to the technology options and mailed them the cost survey. Of the 90 cost survey recipients, 88 returned completed surveys. EPA selected 38 facilities to receive the analytical and production survey based on survey respondents who had indicated that: (1) they had treatment trains similar to the treatment technology options, (2) they had collected analytical data for that treatment train, (3) they had a treatment train with a dedicated outfall from which EPA could evaluate performance, and (4) they did not add excessive dilution water to the outfall before sampling. All 38 analytical and production survey recipients returned completed surveys. EPA included in the public record all information and data collected for which sites have not asserted claims of confidential business information.

3.2 Site Visits

EPA conducted 67 site visits at iron and steel facilities in 19 states and Canada between January 1997 and May 1999. Table 3-2 presents the number of site visits performed in each state. The purpose of the site visits was to collect information about each site's manufacturing operations, wastewater generation, wastewater management practices, and wastewater treatment systems and to evaluate each facility for potential inclusion in the sampling program. EPA also used information collected during site visits to aid in the development of the industry surveys. EPA selected sites to visit based on the type of site (as described in Section 5.1), the manufacturing operations at each facility, the type of steel produced (carbon, alloy, stainless), and the wastewater treatment operations. The Agency wanted to visit all types of iron and steel manufacturing operations as well as all types of wastewater treatment operations. Before sites returned completed surveys, EPA used information collected from the sources used to develop the survey database to select sites to visit. After EPA evaluated the completed surveys, the Agency used information provided by the sites to select additional sites to visit. Table 3-3 summarizes the number of site visits performed at each type of site.

EPA collected detailed information during each site visit on the manufacturing processes, wastewater generation, in-process treatment and recycling systems, management practices and pollution prevention, end-of-pipe treatment technologies, and, if the facility was a candidate for sampling, the logistics of collecting samples. The Agency observed the following manufacturing processes: coke plants, sinter plants, briquetting plants, blast furnaces, direct reduced ironmaking plants, an iron carbide plant, basic oxygen furnaces, electric arc furnaces, vacuum degassers, ladle metallurgy stations, continuous and ingot casting facilities, hot forming mills, and cold forming mills. The Agency also observed acid pickling, descaling, and surface cleaning and coating operations (i.e., manufacturing lines or areas with acid cleaning, alkaline cleaning, annealing, electroplating, and/or hot dip coating operations). Table 3-4 summarizes the number of sites visited that performed any of these manufacturing processes.

EPA observed in-process wastewater treatment and recycling systems, pretreatment systems, and end-of-pipe wastewater treatment systems that were either dedicated to a manufacturing process or shared by multiple processes. Wastewater treatment operations included biological treatment, metals precipitation, solids settling, alkaline chlorination, and filtration systems. EPA included in the public record all information and data collected during site visits for which sites have not asserted claims of confidential business information.

3.3 Sampling

After evaluating information obtained during the site visits, EPA selected 16 sites at which to perform wastewater sampling. EPA selected sites for sampling using the following criteria:

- The site performed operations either currently regulated under 40 CFR Part 420 or identified in the Preliminary Study as being operations performed in the iron and steel industry;
- The site performed high-rate recycling, in-process treatment, or end-of-pipe treatment operations that EPA believed may represent potential model treatment technology; and
- The site's compliance monitoring data indicated that it was among the better performing treatment systems in the industry, based on comparisons of monitoring data from other facilities and with limits from the 1982 regulation.

Table 3-5 shows the type and number of manufacturing processes sampled during the EPA sampling program.

During each sampling episode, EPA collected samples of untreated process wastewater, treatment system effluents, source water to characterize background concentrations, and other samples to characterize the performance of individual treatment units. Table 3-6 summarizes the treatment systems sampled during the sampling program.

In general, the Agency collected 24-hour composite samples from wastewater sampling points each day of the sampling episode. Exceptions to this rule include samples collected for volatile organics analysis and oil and grease (O&G), which EPA collected as multiple grabs over each 24-hour period (laboratory personnel composited the volatile organics samples before analysis, while EPA mathematically composited the O&G analytical results after the analyses were performed). EPA collected a one-time grab sample from each water source contributing to the manufacturing processes sampled. The Agency collected all waste oil and treatment system sludge samples as one-time grab samples.

EPA analyzed wastewater samples for up to approximately 300 analytes spanning the following pollutant classes: conventional, priority, and nonconventional pollutants, including

metals, volatile organic constituents, semivolatile organic constituents, and dioxins and furans. Analyte selection was based on knowledge of the manufacturing processes and raw materials used. EPA generally collected samples using the following guidelines:

- Five days of samples for conventionals, nonconventional and priority metals, and certain other nonconventional pollutants, including total dissolved solid (TDS), chlorides, fluorides, sulfates, total organic carbon (TOC), chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN), nitrate/nitrite, ammonia as nitrogen, and total phenols;
- Five days of samples from biological treatment systems for five-day biochemical oxygen demand (BOD₅) and five-day carbonaceous biochemical oxygen demand (CBOD₅);
- Five days of samples from cokemaking, blast furnace ironmaking, and sintering wastewater for total sulfide, thiocyanate, amenable cyanide, total cyanide, and weak acid dissociable (WAD) cyanide;
- Five days of samples from cokemaking wastewater for organics and dioxins/furans, because the Agency believed limitations development for these parameters was likely;
- Three days of samples from all noncokemaking wastewater for organics to screen and provide sufficient data for potential limitations development;
- Two days of samples from blast furnace ironmaking, sintering, and basic oxygen furnace steelmaking wastewater for dioxins/furans to screen and provide sufficient data for potential limitations development;
- Five days of samples from carbon and alloy steel finishing treatment systems containing chromium-bearing wastewater from electroplating or hot coating operations and stainless steel finishing treatment systems for hexavalent chromium;
- On two occasions (one cokemaking plant and one direct reduced ironmaking plant), the Agency performed a one-day screening for pollutants of concern.

Table 3-7 shows the EPA wastewater analytical methods used and parameters analyzed for during the sampling program, the manufacturing processes for which the analyte was analyzed, and the general frequency with which samples were collected during the sampling program. EPA analyzed one-time grab waste oil and sludge samples for metals, volatile and semivolatile organic constituents, total phenols, and dioxins/furans, depending on the treatment system from which they were collected.

Analytical results from untreated samples contributed to EPA's characterization of the industry, development of the list of pollutants of concern, and development of raw wastewater characteristics. EPA used data from both untreated wastewater samples and treated effluent samples to evaluate treatment system performance, to develop pollutant loadings and removals, and, under the focused rulemaking approach described in Section 8, to develop the proposed model treatment technology options for the iron and steel industry. EPA used data collected from treated effluent sampling points to calculate the long-term averages (LTAs) and limitations for each of the proposed regulatory options. During each sampling episode, EPA also collected flow rate data corresponding to each sample collected and production information from each associated manufacturing operation for use in calculating pollutant loadings and production-normalized flow rates. EPA included in the public record all information and data collected during sampling episodes for which sites have not asserted claims of confidential business information.

3.4 Other Data Sources

EPA evaluated existing data sources to gather technical and financial information about the iron and steel industry, as discussed below.

The Agency gathered technical information from iron and steel industry trade journals published from 1985 through 1997 as well as information from Iron and Steel Society conference proceedings. Trade journals included Iron and Steel Engineer, published by the Association of Iron and Steel Engineers (AISE) (Reference 3-25), Iron and Steelmaker, published by the Iron and Steel Society (ISS) (Reference 3-26), and New Steel (formerly Iron Age), published by Chilton Publications (Reference 3-27). EPA obtained the following types of information from these sources: storm-water and wastewater issues, new and existing wastewater treatment technologies, wastewater treatment and manufacturing equipment upgrades and installations, and company mergers, acquisitions, and joint ventures. EPA also used these sources to identify potential survey recipients and facilities for site visits.

EPA consulted the following publications: Census Manufacturers - Industry Series and Current Industrial Reports (U.S. Bureau of Census) (References 3-28 and 3-29); World Steel Dynamics (Paine Webber) (References 3-30 through 3-36); and The Annual Statistical Report (American Iron and Steel Institute) (Reference 3-37). These sources provided a variety of financial information, ranging from aggregate data on employment and payroll to steel shipments by product, grade, and market.

The Agency performed searches on the following on-line databases: Pollution Abstracts, Water Resources Abstracts, Engineering Index, Materials Business File, National Technical Information Service (NTIS), Enviroline, Compendex, and Metadex (References 3-38 through 3-45). The Agency also searched EPA's TRI (Reference 3-20) and PCS databases (Reference 3-19). In addition, the Agency reviewed secondary sources, including data, reports, and analyses published by government agencies, reports and analyses published by the iron and steel industry and its associated organizations, and publicly available financial information compiled by both government and private organizations.

3.5 Public Participation

EPA has encouraged participation of all interested parties throughout the development of the proposed Iron and Steel Category effluent limitations guidelines and standards. EPA has conducted outreach with the following trade associations (which represent the vast majority of the facilities that will be affected by this guideline): American Iron and Steel Institute (AISI), Steel Manufacturers Association (SMA), Specialty Steel Industry of North America (SSINA), Cold Finished Steel Bar Institute (CFSBI), Wire Association International, Incorporated (WAI), American Wire Producers Association (AWPA), Steel Tube Institute of North America (STINA), American Galvanizers Association, Incorporated (AGA), and American Coke and Coal Chemicals Institute (ACCCI). EPA has met on several occasions with various industry representatives to discuss aspects of the regulation development. EPA has also participated in industry meetings and has given presentations on the status of the regulation development.

Because some facilities affected by the proposal are indirect dischargers, the Agency also conducted outreach to publicly owned treatment works (POTWs). EPA also made a concerted effort to consult with pretreatment coordinators and state and local entities who will be responsible for implementing the iron and steel regulation.

EPA sponsored five stakeholders' meetings between December 1998 and January 2000. Four were held in Washington, D.C. and the fifth was held in Chicago, Illinois. The primary objectives of the meetings were to present the Agency's current thinking regarding the technology bases for the proposed revisions to 40 CFR Part 420 and to seek dialogue, discuss issues, and obtain new ideas from interested stakeholders, including industry representatives and members of environmental groups such as the Natural Resources Defense Council (NRDC), the Environmental Defense Fund (now Environmental Defense), Atlantic States Legal Foundation, Friends of the Earth, and Save the Dunes.

During the meetings, EPA presented process flow diagrams showing preliminary technology options and potential best management practices (BMPs) that may be incorporated into a revised Part 420 and/or included in NPDES permit and pretreatment guidance. The presentations were organized by type of manufacturing process. In addition to soliciting comments on the preliminary options, EPA requested ideas from the stakeholders to identify useful incentives for greater pollution control.

At the meetings, EPA encouraged participants to supplement their oral statements with written comments and supporting data. In that regard, EPA provided a set of data quality protocols for use when submitting data for the iron and steel rulemaking effort. This handout, along with all other handouts and meeting summaries, is posted on the EPA iron and steel industry web site at <http://www.epa.gov/OST/ironsteel/>. All of the materials presented at the stakeholders' meetings, as well as meeting summaries and any written comments from participants not containing confidential business information, are also in the public record for the proposed regulation.

3.6 References

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Table 3-1**Iron And Steel Industry Strata**

Stratum Number	Stratum Name	Number of Sites in Stratum	Number of Sites Receiving Surveys
1	Integrated steel sites with cokemaking	9	9
2	Integrated steel sites without cokemaking	12	12
3	Stand-alone cokemaking sites	16	16
4	Stand-alone direct reduced ironmaking and sintering sites	5	5
5	Detailed survey certainty stratum ^{a, b}	60	60
6	Non-integrated steel sites	69	40
7	Stand-alone finishing sites and stand-alone hot forming sites	54	35
8	Short survey certainty stratum ^{b, c}	13	13
9	Stand-alone cold forming sites	62	37
10	Stand-alone pipe and tubes sites	164	59
11	Stand-alone hot coating sites	106	49
12	Stand-alone wire sites	252	67
	Total	822	402

^aThis stratum includes facilities from strata 6 and 7.

^bThis stratum includes data transferred from one site that received an MP&M survey.

^cThis stratum includes facilities from strata 9 through 12.

Table 3-2**Number of Site Visits Conducted in Each State and in Canada**

State	Number of Site Visits Conducted
Alabama	6
Arizona	1
Arkansas	1
California	2
Canada	2
Illinois	6
Indiana	10
Kentucky	1
Louisiana	1
Maryland	2
Michigan	2
New York	2
Ohio	10
Oregon	1
Pennsylvania	10
South Carolina	1
Texas	2
Utah	2
Virginia	2
West Virginia	3
Total	67

Table 3-3**Number of Site Visits Conducted at Each Type of Site**

Type of Site	Number of Site Visits Conducted
Integrated mill with cokemaking	11
Integrated mill without cokemaking	9
Stand-alone cokemaking plant	12
Stand-alone sintering plant ^a	1
Stand-alone direct reduced ironmaking plant ^b	1
Non-integrated mill	16
Stand-alone hot forming mill	1
Stand-alone finishing mill	10
Stand-alone pipe and tube mill	5
Stand-alone iron carbide mill	1
Total	67

^aEPA visited eight additional sintering plants at integrated mills.

^bEPA visited one additional direct reduced ironmaking mill at a non-integrated mill.

Table 3-4**Number of Sites Visited With Each Type of Manufacturing Process**

Manufacturing Process	Number of Sites with Each Type of Manufacturing Process
Cokemaking	23
Sintering	9
Briquetting	4
Blast furnace ironmaking	20
Direct reduced ironmaking	2
Iron carbide	1
Basic oxygen furnace steelmaking	19
Electric arc furnace steelmaking	18
Vacuum degassing	17
Ladle metallurgy	33
Casting ^a	33
Hot forming ^b	36
Cold forming	34
Acid pickling or descaling	28
Surface cleaning and coating ^c	28

^aCasting operations include ingot casting and continuous casting.

^bHot forming operations include hot rolling, forging, seamless pipe and tube, and butt-welded pipe and tube.

^cSurface cleaning and coating operations include acid cleaning, alkaline cleaning, annealing, electroplating, and hot coating operations.

Table 3-5**Manufacturing Processes Sampled**

Manufacturing Process	Number of Processes Sampled
Cokemaking	4
Sintering	2
Blast furnace ironmaking	3
Direct reduced ironmaking	1
Basic oxygen furnace steelmaking	5
Vacuum degassing	2
Continuous casting	6
Hot forming ^a	7
Descaling	2
Acid pickling	7
Cold forming	5
Surface cleaning or coating ^b	4

^aHot forming operations include hot rolling, forging, seamless pipe and tube, and butt-welded pipe and tube.

^bSurface cleaning and coating operations include acid cleaning, alkaline cleaning, annealing, electroplating, and hot coating operations.

Table 3-6**Treatment Systems Sampled**

Treatment System	Treatment System Description	Samples Collected
1	Coke plant treatment system with ammonia stripping and biological treatment	Ammonia still influent, ammonia still effluent, biological treatment system effluent
2	Coke plant treatment system with ammonia stripping and biological treatment	Ammonia still influent, ammonia still effluent, biological treatment system effluent
3	Coke plant treatment system with ammonia stripping, biological treatment, and sand and granular activated carbon filtration	Flushing liquor, by-products recovery wastewater, equalization tank effluent, biological treatment system effluent, sand filter effluent, carbon filter effluent
4	Coke plant treatment system with ammonia stripping and biological treatment	Ammonia still influent, ammonia still effluent, biological treatment system effluent
5	Sinter plant treatment and high-rate recycle system	Sinter plant untreated wastewater, treatment system effluent
6	Blast furnace and sinter plant blowdown treatment and high-rate recycle system	Blast furnace scrubber untreated wastewater, sinter plant scrubber untreated wastewater, blast furnace treatment blowdown, sinter plant treatment blowdown, combined final effluent, treatment system sludge
7	Blast furnace treatment and high-rate recycle system	Blast furnace untreated wastewater, recycle wastewater, filter press sludge
8	Blast furnace treatment and high-rate recycle system	Blast furnace untreated wastewater, treatment system blowdown, treatment system filter cake
9	Direct reduced iron treatment and high-rate recycle system	Clarifier influent, sand filter influent, treatment system effluent
10	Basic oxygen furnace treatment and high-rate recycle system	Basic oxygen furnace untreated wastewater, recycle water
11	Basic oxygen furnace blowdown treatment system	Classifier effluent, thickener effluent, treatment system effluent, vacuum filter cake
12	Steelmaking (vacuum degasser, continuous caster) treatment and high-rate recycle system	Vacuum degasser untreated wastewater, clarifier overflow, filter effluent, continuous caster untreated wastewater, treatment system effluent
13	Basic oxygen furnace treatment and high-rate recycle system	Basic oxygen furnace untreated wastewater, untreated gas cooling water, thickener overflow, drum filter sludge, filter press sludge

Table 3-6 (Continued)

Treatment System	Treatment System Description	Samples Collected
14	Steelmaking (basic oxygen furnaces, vacuum degasser, continuous casters) treatment and high-rate recycle system	Continuous caster untreated wastewater, vacuum degasser untreated wastewater, clarifier underflow, thickener underflow, treatment system blowdown
15	Continuous caster treatment and high-rate recycle system	Scale pit influent, treatment system effluent
16	Continuous caster treatment and high-rate recycle system	Continuous caster untreated wastewater, sand filter effluent
17	Continuous caster treatment and high-rate recycle system	Continuous caster scale pit influent, sand filter effluent, scale pit waste oil
18	Continuous caster treatment and high-rate recycle system	Continuous caster untreated wastewater, treatment system effluent, scale pit waste oil
19	Hot strip mill treatment and high-rate recycle system	Hot strip mill untreated wastewater, treatment system effluent
20	Hot strip mill treatment and high-rate recycle system	Continuous caster untreated wastewater, vacuum degasser untreated wastewater, hot strip mill untreated wastewater, treatment system blowdown
21	Hot strip mill treatment and high-rate recycle system	Roughing mill untreated wastewater, finishing mill untreated wastewater, roughing mill sand filter effluent, finishing mill sand filter effluent, waste oil
22	Hot strip mill blowdown treatment and high-rate recycle system	Hot strip mill untreated wastewater, treatment system blowdown, scale pit waste oil
23	Hot strip mill treatment and high-rate recycle system	Hot mill scale pit influent, treatment system effluent, scale pit waste oil
24	Hot mill treatment and high-rate recycle system	Hot mill untreated wastewater, treatment system effluent, blowdown polishing system blowdown, scale pit waste oil
25	Hot strip mill treatment and high-rate recycle system	Sand filter influent, treatment system effluent
26	Oily wastewater treatment system	Oily wastewater influent, treatment system effluent
27	Plate mill treatment system	Scale pit influent, scale pit effluent, scale pit waste oil
28	Steel finishing chemical precipitation system	Acid pickling untreated wastewater, galvanizing untreated wastewater, sand filter influent, sand filter effluent
29	Steel finishing chemical precipitation system with chromium reduction pretreatment	Acid pickling untreated wastewater, chromium reduction pretreatment influent, chromium reduction pretreatment effluent, sand filter influent, sand filter effluent

Table 3-6 (Continued)

Treatment System	Treatment System Description	Samples Collected
30	Steel finishing chemical precipitation system with chromium reduction pretreatment	Acid pickling untreated wastewater, cold forming untreated wastewater, electrogalvanizing untreated wastewater, hot dip coating untreated wastewater, oily wastewater, chromium reduction pretreatment effluent, intermediate treatment, final effluent
31	Steel finishing chemical precipitation system	Acid pickling untreated wastewater, cold forming untreated wastewater, treatment system effluent
32	Steel finishing chemical precipitation system with chromium reduction pretreatment	Acid pickling untreated wastewater, descaling untreated wastewater, chromium reduction pretreatment effluent, treatment system effluent
33	Steel finishing chemical precipitation system	Electroplating solution, treatment system influent, clarifier effluent, sand filter effluent
34	Steel finishing chemical precipitation system	Acid pickling untreated wastewater, oily wastewater, treatment system effluent
35	Steel finishing chemical precipitation system with oily wastewater pretreatment and chromium pretreatment	Continuous annealing untreated wastewater, alkaline cleaning untreated wastewater, electroplating untreated wastewater, hot dip coating untreated wastewater, acid pickling untreated wastewater, oily wastewater pretreatment influent, oily wastewater pretreatment effluent, chromium reduction pretreatment influent, chromium reduction pretreatment effluent, treatment system influent, treatment system effluent
36	Steel finishing chemical precipitation system	Acid pickling untreated wastewater, electrogalvanizing untreated wastewater, treatment system effluent

Table 3-7**Wastewater Analytical Methods Used During Sampling Program**

EPA Method	Parameter	Manufacturing Processes	Typical Sampling Frequency (Days/Episode)
160.2	Total suspended solids (TSS)	All	5
160.1	Total dissolved solids (TDS)	All	5
325.2 or 325.3	Chlorides	All	5
340.1, 340.2, 340.3	Fluorides	All	5
375.1, 375.3, 375.4	Sulfates	All	5
150.1	pH	All	5
415.1	Total organic carbon (TOC)	All	5
410.1, 410.2, or 410.4	Chemical oxygen demand (COD)	All	5
351.1, 351.2, 351.3, 351.4	Total Kjeldahl nitrogen (TKN)	All	5
353.1, 353.2, or 353.3	Nitrate/nitrite	All	5
350.1, 350.2, or 350.3	Ammonia as nitrogen	All	5
405.1	Five-day biochemical oxygen demand (BOD ₅)	Cokemaking	5
405.1	Five-day carbonaceous biochemical oxygen demand (CBOD ₅)	Cokemaking	5
1664	Hexane extractable material (oil and grease)	All	5
1664	Silica-gel treated hexane extractable material (total petroleum hydrocarbons)	All	5
420.1 or 420.2	Total phenols	All	5
376.1, 376.2	Total sulfide	Cokemaking, blast furnace ironmaking, sintering	5
4500CN Part M	Thiocyanate	Cokemaking, blast furnace ironmaking, sintering	5
335.1, 335.2, and 1677	Cyanide (amenable), cyanide (total), and weak acid dissociable cyanide, respectively	Cokemaking, blast furnace ironmaking, sintering	5

Table 3-7 (Continued)

EPA Method	Parameter	Manufacturing Processes	Typical Sampling Frequency (Days/Episode)
1613B	Dioxins/furans	Cokemaking, blast furnace ironmaking, sintering, basic oxygen furnace steelmaking	2 (blast furnace ironmaking, sintering, basic oxygen furnace steelmaking) 5 (cokemaking)
218.4	Hexavalent chromium	Chromium-bearing electroplating and hot coating wastewater from carbon and alloy finishing operations, stainless steel finishing operations	5
1620	Metals	All	5
1624C	Volatile organics	All	3 5 (cokemaking)
1625C	Semivolatile organics	All	3 5 (cokemaking)

SECTION 4

ANALYTICAL METHODS AND BASELINE VALUES

This section describes the analytical methods associated with the concentration data used to develop the proposed limitations and standards. Depending on the subcategory and segment, the proposed rule requires dischargers to measure for up to seven metals, three organic contaminants, 2,3,7,8-TCDF, ammonia as nitrogen, fluoride, oil and grease as hexane extractable material (HEM), thiocyanate, total cyanide, total residual chlorine (TRC), total suspended solids (TSS), and pH. In addition, the preamble to the proposed rule solicits comments on whether nitrate/nitrite should be regulated.

This section discusses the methods used to analyze the samples that EPA and the industry collected from iron and steel wastewater. Section 3 discusses these sampling efforts. This section also discusses how EPA used the results of its wastewater analyses for purposes of calculating the proposed limitations and standards (Section 12 describes the methodology used for those calculations).

Section 4.1 briefly describes baseline values for the pollutants and their importance. Section 4.2 describes the reporting conventions laboratories used in expressing the results of the analysis. Sections 4.3 and 4.4 further explain nominal quantitation limits and baseline values, respectively. Section 4.5 describes the specific analytical methods and the corresponding baseline value for each pollutant that EPA proposes to regulate (pH is excluded from this discussion as the baseline value concept is not relevant¹). Table 4-1 presents the analytical methods and baseline values used for each pollutant in calculating limitations and standards.

4.1 Explanation and Importance of Baseline Values

The database that EPA used to calculate the proposed limitations and standards consists of two types of analytical data: 1) data collected and analyzed by EPA (“sampling episodes”), and 2) industry-supplied data (“self-monitoring episodes”). EPA analyzed all of its wastewater samples using methods identified in Table 4.1. EPA consistently used the same method to analyze all samples for a particular pollutant. However, the methods used for the industry-supplied data varied; these are also identified in Table 4.1. Generally, industry used either EPA methods from Methods for Chemical Analysis of Water and Wastes (MCAWW) or the American Public Health Association’s Standard Methods for the Examination of Water and Wastewater (References 4-1 and 4-2).

¹For pH, the proposed limitations and standards are specified as a range of values between 6 and 9. In analyzing pH levels, laboratories typically use methods such as EPA Method 150.1 or Standard Method 4500 H⁺ B, which are classical wet chemistry methods. The baseline concept is not relevant because the lowest pH readings would be extremely acidic and unexpected in treated effluent from this industry regardless of the treatment technology.

As described further in Section 4.4, in using this database, EPA compared the reported concentrations for each pollutant to a baseline value. Regardless of the data source, EPA needed to use a single baseline value for each pollutant in these comparisons. EPA used the nominal quantitation limits associated with the analytical methods employed in its sampling episodes as the basis for determining each “baseline value.” EPA determined that this was appropriate because EPA consistently used a single method for each pollutant while industry used a range of different methods. Consequently, the baseline value for each pollutant is the nominal quantitation limit associated with the analytical method EPA used to analyze that pollutant in its sampling episodes. Table 4-1 identifies these baseline values.

In general, the term “nominal quantitation limit” describes the smallest quantity of an analyte that can be measured reliably with a particular analytical method. In some cases, however, EPA used a value lower than the nominal quantitation limit as the baseline value because submitted data demonstrated that reliable measurements could be obtained at a lower level. In a few instances, EPA concluded that the nominal quantitation limit for a specified method was less than the level that laboratories could reliably achieve. For those pollutants, EPA modified the nominal quantitation limit upward and used a higher value as the baseline value. Section 4.3 discusses these instances and the nominal quantitation limit for each pollutant further.

4.2 Reporting Conventions Associated with Analytical Results

Most of the analytical data were reported as liquid concentrations in weight/volume units (e.g., micrograms per liter ($\mu\text{g/L}$)). In a few instances, the results were provided in weight/weight solids units (e.g., milligrams per kilogram (mg/kg)). In those instances, EPA converted the solids results into weight/volume units by using a conversion factor based upon the percent of solids in the sample. In addition, EPA converted data supplied in weight/time units to weight/volume units.²

The laboratories expressed the result of the analysis either numerically or as “not quantitated”³ for a pollutant in a sample. When the result is expressed numerically, then the pollutant was quantitated⁴ in the sample. For example, for a hypothetical pollutant X, the result would be reported as “15 $\mu\text{g/L}$ ” when the laboratory quantitated the amount of pollutant X in the sample as being 15 $\mu\text{g/L}$. For the nonquantitated results for each sample, the laboratories reported a “sample-specific quantitation limit.”⁵ For example, for the hypothetical pollutant X,

²Some facilities reported the results in lbs/day and included the flow rates for each day. EPA used this information to convert the results to mg/L .

³Elsewhere in this document and in the preamble to the proposed rule, EPA refers to pollutants as “not detected” or “nondetected.” This section uses the term “not quantitated” or “nonquantitated” rather than nondetected.

⁴Elsewhere in this document and in the preamble to the proposed rule, EPA refers to pollutants as “detected.” This section uses the term “quantitated” rather than detected.

⁵Elsewhere in this document and in the preamble to the proposed rule, EPA refers to a “sample-specific quantitation limit” as a “sample-specific detection limit” or, more simply, as a “detection limit.”

the result would be reported as “<10 µg/L” when the laboratory could not quantitate the amount of pollutant X in the sample. That is, the analytical result indicated a value less than the sample-specific quantitation limit of 10 µg/L, meaning the actual amount of pollutant X in that sample is between zero (i.e., the pollutant is not present) and 10 µg/L. The sample-specific quantitation limit for a particular pollutant is generally the smallest quantity in the calibration range that can be measured reliably in any given sample. If a pollutant is reported as not quantitated in a particular wastewater sample, it does not mean that the pollutant is not present in the wastewater, merely that analytical techniques (whether because of instrument limitations, pollutant interactions or other reasons) do not permit its measurement at levels below the sample-specific quantitation limit.

In its calculations, EPA generally substituted the value of the reported sample-specific quantitation limit for each nonquantitated result. In a few cases when the sample-specific quantitation limit was less than the baseline value, EPA substituted the baseline value for the nonquantitated result. In a few instances when the quantitated value was below the baseline value, EPA considered these values to be nonquantitated in the statistical analyses and substituted the baseline value for the measured value. Section 4.3 further discusses these cases.

4.3 Nominal Quantitation Limits

Protocols used for determining nominal quantitation limits in a particular method depend on the definitions and conventions that EPA used at the time the method was developed. As stated previously, the nominal quantitation limit is the smallest quantity of an analyte that can be reliably measured with a particular method. The nominal quantitation limits associated with the EPA methods addressed in the following sections fall into three general categories. The first category includes Methods 1613B, 1625, and 1664, which use the minimum level (ML) definition as the lowest level at which the entire analytical system must give a recognizable signal and an acceptable calibration point for the analyte. The second category pertains specifically to Method 1620, and is explained in detail in Section 4.5.2. The third category pertains to the remainder of the methods in which a variety of terms are used to describe the lowest level at which measurement results are quantitated. These include the classical wet chemistry methods and several EPA methods for the determination of metals and organics. In some cases (especially with the classical wet chemistry analytes), the methods are older (1970s and 1980s) and different concepts of quantitation apply. These methods typically list a measurement range or lower limit of measurement. The terms differ by method and, as discussed in subsequent sections, the levels presented do not always represent the lowest levels laboratories can currently achieve. For those methods associated with a calibration procedure, the laboratories demonstrated through a low point calibration standard that they were capable of reliable quantitation at method-specified (or lower) levels. In such cases, these nominal quantitation limits are operationally equivalent to the ML (though not specifically identified as such in the methods). In the case of titrimetric or gravimetric methods, the laboratory adhered to the established lower limit of the measurement range published in the methods. Section 4.5 presents details of the specific methods.

4.4 Comparisons to Baseline Values

Depending on the analytical method, EPA performed one of two types of comparisons of the concentration data to the baseline values. This subsection describes each type of comparison and its application.

4.4.1 Comparison Type 1

Comparison Type 1 was used when the baseline value was based upon method-defined minimum levels of Methods 1613B, 1625, or 1664 (see Section 4.5.1). For these methods, the baseline values are based upon minimum levels (ML) that are developed through inter-laboratory studies to determine the lowest measurable level (Section 4.5.1 provides a more precise definition).

EPA applied Comparison Type 1 *before* using the data to calculate the long-term averages and variability factors⁶ used for the proposed limitations and standards. EPA compared each analytical result (i.e., quantitated value or sample-specific quantitation limit for a non-quantitated value) to the baseline value for the pollutant. The objective of this comparison was to identify any results reported below the method-defined ML of quantitation. Results reported below the method-defined ML were changed to the ML to ensure that all results used by EPA were quantitatively reliable. In addition, any quantitated value changed to the ML was also considered to be nonquantitated⁷ in calculating the proposed limitations and standards. In most cases, the quantitated values and sample-specific quantitation limits were equal to or greater than the baseline values.

An example of Comparison Type 1: Suppose a facility dataset had five values for HEM, of which two were nonquantitated with sample-specific quantitation limits of 2 mg/L and 6 mg/L and the remaining three values were quantitated at 4 mg/L, 25 mg/L, and 50 mg/L. In applying Comparison Type 1, EPA used the baseline value of 5 mg/L for HEM and compared this to all five values. Because the sample-specific quantitation limit of 2 mg/L is less than 5 mg/L, EPA changed this sample-specific quantitation limit to 5 mg/L. EPA also changed the quantitated value of 4 mg/L to 5 mg/L and considered the value to be a sample-specific quantitation limit (i.e., nonquantitated) rather than a quantitated value. The remaining sample-specific quantitation limit of 6 mg/L and the two quantitated values of 25 mg/L and 50 mg/L remained the same because they were greater than the baseline value of 5 mg/L.

4.4.2 Comparison Type 2

Comparison Type 2 was used when the baseline value was based upon methods that do not use the minimum level concept to define quantitation limits (i.e., all methods except Methods 1613B, 1625, and 1664). The baseline values corresponding to Comparison Type 2

⁶Section 12 describes the calculations of long-term averages and variability factors.

⁷As explained in Appendix E, EPA applied different statistical assumptions to quantitated and nonquantitated results.

generally were the nominal quantitation limit associated with the method used for EPA's sampling episodes. For example, total cyanide's baseline value of 0.02 mg/L is equal to the nominal quantitation limit of 0.02 mg/L for total cyanide by Method 335.2, which was used to analyze EPA samples. In the case of several pollutants, however, EPA determined that the baseline value should differ from the nominal quantitation limit as specified in the method for the pollutant. EPA made exceptions based upon its knowledge about the methods, experiences with laboratories using those methods, and the need for a single baseline value for each pollutant. Section 4.5 notes specific exceptions.

EPA applied Comparison Type 2 *after* using the data to calculate the long-term average and the variability factors for each option and subcategory. In this comparison, EPA compared the calculated long-term average to the baseline value for the pollutant. If the calculated long-term average was less than the baseline value, EPA used the baseline value to calculate the proposed limitation (which is calculated as the product of the long-term average and the variability factor). EPA used this approach because some laboratories have demonstrated that, under certain conditions, they can measure to levels lower than those specified in some of the methods. EPA believes that these results are quantitatively reliable, and therefore can be used to calculate long-term averages. However, EPA also recognizes that not all laboratories consistently quantitate to these lower levels. To ensure the proposed limitations reflect "typical" laboratory reporting levels for the approved methods, EPA established the long-term averages at values equal to or greater than the reporting levels specified in the approved methods. Table 12-4 identifies the cases for which EPA used the baseline values instead of the calculated long-term averages.

An example of Comparison Type 2: Suppose the long-term average for a particular option was 2 mg/L, and the daily variability factor was 2.0. Further suppose that the baseline value was 10 mg/L. Without this comparison, EPA would have proposed a limitation of 4 mg/L ($= 2 \text{ mg/L} \times 2.0$), which is less than the baseline value of 10 mg/L. However, by performing this comparison, EPA would have identified that the baseline value was greater than the long-term average. As a result, EPA would have substituted the baseline value for the long-term average and proposed a limitation of 20 mg/L ($= 10 \text{ mg/L} \times 2.0$).

The following subsection briefly describes the analytical methods and explains any differences between the nominal quantitation limits and the baseline values.

4.5 Analytical Methods

Table 4-1 summarizes the analytical methods, the associated pollutants measured by the method, the nominal quantitation levels, the baseline levels, and the assumptions for values reported below the baseline levels. The following subsections provide additional information supporting Table 4-1 which is located at the end of Section 4. (The subsections are listed in the order by method number.)

In developing the proposed limitations and standards, EPA generally used only data from analytical methods approved for compliance monitoring or those that EPA has used for

decades in support of effluent limitations guidelines and standards development. The exceptions included industry-supplied data from one facility. The facility did not include any information on the analytical methods corresponding to these reported concentration values. However, because the data were collected at the sampling points specified for compliance monitoring, EPA has assumed that the data were measured by analytical methods specified in or approved under 40 CFR Part 136 that facilities are required to use for compliance monitoring. (The remainder of this section refers to such methods as ‘NPDES-approved’⁸ or ‘nonapproved.’) For the final rule, EPA intends to contact the facility to confirm its assumption for these data. Other exceptions were for nonapproved methods as explained in the following sections. Except for TSS determined by Method 209C (see Section 4.5.3), EPA excluded data from nonapproved methods from its calculations of limitations and standards. Pending receipt of additional information about such data from the industry, EPA will reevaluate the exclusion of these data for the final rule.

4.5.1 Methods 1613B, 1625, 1664 (TCDF, Benzo(a)pyrene, Naphthalene, Phenol, HEM)

As stated earlier, Method 1613B for dioxins, Method 1625 for semivolatile organic compounds, and Method 1664 for HEM and silica gel treated n-hexane extractable material (SGT-HEM)⁹ use the ML concept for quantitation of the pollutants measured by the methods. The ML is defined as the lowest level at which the entire analytical system must give a recognizable signal and an acceptable calibration point for the analyte. When an ML is published in a method, the Agency has demonstrated that at least one well-operated laboratory can achieve the ML, and when that laboratory or another laboratory uses that method, the laboratory is required to demonstrate, through calibration of the instrument or analytical system, that it can make measurements at the ML.

For these methods, EPA’s methodology is that if a quantitated value or sample-specific quantitation limit was reported with a value less than the ML specified in a method, EPA substituted the value of the ML and assumed that the measurement was nonquantitated. For example, if the ML was 10 µg/L and the laboratory reported a quantitated value of 5 µg/L, EPA assumed that the concentration was nonquantitated with a sample-specific quantitation limit of 10 µg/L.

Of the analytes measured by these three methods, EPA is proposing to regulate 2,3,7,8-tetrachlorodibenzo-furan (TCDF) (Method 1613B); benzo(a)pyrene, naphthalene, and phenol (Method 1625); and HEM (Method 1664). For these pollutants, EPA selected the ML as basis for the baseline values. None of the reported values from these methods were less than the ML; therefore, no substitutions were made to data from EPA’s sampling episodes. However, in calculating the limitations and standards for naphthalene, EPA also included data generated from Method 625 (see Section 4.5.14).

⁸NPDES is the acronym for the National Pollutant Discharge Elimination System.

⁹SGT-HEM measures nonpolar material (i.e., n-hexane extractable material that is not absorbed by silica gel). Method 1664 measures both oil and grease and nonpolar material.

4.5.2 Method 1620 and 200.7 (Chromium, Lead, Mercury, Nickel, Selenium, Zinc)

Method 1620 for metals determination uses the concept of an instrument detection limit (IDL), which is defined as “the smallest signal above background noise that an instrument can detect reliably.”¹⁰ EPA used Method 1620 to determine metals in the samples collected during its sampling episodes. While Method 1620 is not an approved method for compliance monitoring, it represents a consolidation of several 40 CFR 136 approved methods such as Method 200.7 (inductively coupled plasma atomic emission (ICP) spectroscopy for trace elements) and Method 245.1 (mercury by cold vapor atomic absorption technique). Some industry-supplied results for chromium, lead, nickel, and zinc were determined by Method 200.7. Other industry-supplied results for metals were determined by Methods 239.2, 245.1, 3120B, 3130B, as discussed in Sections 4.5.5 through 4.5.8. In calculating the proposed limitations and standards, EPA included data from these methods and also chromium and nickel data for which industry did not identify the analytical methods used.

Data-reporting practices for Method 1620 analysis follow conventional metals reporting practices used in other EPA programs, in which values are required to be reported at or above the IDL. In applying Method 1620, each analytical laboratory participating in the data gathering efforts by EPA’s Engineering and Analysis Division (EAD) determine IDLs on a quarterly basis. The IDLs are, therefore, laboratory- and time-specific. Though Method 1620 does contain MLs, these MLs predate EPA’s recent refinement of the minimum level concept described in Section 4.5.1. The ML values associated with Method 1620 are based on a consensus reached by EPA and laboratories during the 1980s regarding levels that could be considered reliable quantitation limits when using Method 1620. These limits do not reflect advances in technology and instrumentation since the 1980s. Consequently, EPA used the IDLs as the lowest values for reporting purposes, with the general understanding that reliable results can be produced at or above the IDL.

EPA is proposing to regulate chromium, lead, mercury, nickel, selenium, and zinc. For the samples collected during its sampling episodes, EPA used Method 1620 to measure these analytes. The Agency used the Method 1620 ML values as the baseline values for these analytes, with the exception of lead. In Method 1620, lead has an ML of 5 µg/L for graphite furnace atomic absorption (GFAA) spectroscopy analysis; EPA determined, however, that it was not necessary to measure down to such low levels, and that lead could instead be analyzed by inductively coupled plasma atomic emission (ICP) spectroscopy. Consequently, for the purposes of EAD’s data gathering efforts, the required ML for lead was adjusted to 50 µg/L.

Though the baseline values were derived from the ML (or adjusted ML) in Method 1620, EPA used the laboratory-reported quantitated values and sample-specific quantitation limits, which captured concentrations down to the IDLs, in calculating the proposed limitations and standards. EPA calculated each limitation and standard as the product of the long-term

¹⁰Keith, L.H., W. Crummett, J. Deegan, R.A. Libby, J.K. Taylor, G. Wentler. “Principles of Environmental Analysis,” *Analytical Chemistry*, Volume 55, 1983, Page 2217.

average and the variability factor. If the long-term average for a pollutant was less than the baseline value, EPA used the baseline value instead of the long-term average in the calculations. This was the case for lead for several subcategories (see Table 12-4).

4.5.3 Method 160.2, 209C, and 2540D (Total Suspended Solids)

Total suspended solids (TSS) was determined by Method 160.2 for samples collected by EPA and some samples collected by the industry. Industry also used Method 209C and 2540D to measure TSS. (EPA also used TSS data for which industry did not identify the analytical methods used.) Methods 160.2 and 2540D are NPDES-approved and are essentially identical methods. While it is not currently NPDES-approved, Method 209C for TSS appears in the 15th and 16th editions of Standard Methods and was approved in the CFR in 1986. Since then, the method numbers have been updated in more recent editions of Standard Methods and in the CFR, but the analytical procedures in Method 209C are identical to those of Method 2540D. Therefore, EPA determined that the data from all three methods should produce similar results and thus are usable for the purposes of rulemaking development.

Because EPA used Method 160.2 for its sampling episodes, the Agency selected the nominal quantitation limit of 4 mg/L from Method 160.2 as the basis for the baseline value. In calculating the proposed limitations and standards, EPA used the laboratory-reported quantitated values and sample-specific quantitation limits. If the long-term average was less than the baseline value, however, EPA substituted the baseline value for the long-term average. This was the case for the TSS new source performance standard (NSPS) for the Stainless Steel Segment of the Steel Finishing Subcategory.

4.5.4 Method 218.4 (Hexavalent Chromium)

For EPA-collected samples, hexavalent chromium was determined by Method 218.4, an NPDES-approved procedure that utilizes atomic absorption for the determination of hexavalent chromium after chelation and extraction. In developing the proposed limitations and standards, EPA included industry-supplied data for which industry did not cite the analytical methods used. Industry also supplied data determined by Method 3120. Because of concerns about the use of this method (see Section 4.5.7), EPA excluded these data from the calculation of the proposed limitations and standards.

In Method 218.4, the nominal quantitation limit or lower limit of the measurement range is 0.01 mg/L. Because EPA used this method, this nominal quantitation limit was used as the baseline value used for all hexavalent chromium results. None of the hexavalent chromium data determined by Method 218.4 had quantitated values or sample-specific quantitation limits lower than the baseline value.

4.5.5 Method 239.2 (Lead)

In developing the proposed limitations and standards for lead, EPA included industry-supplied data from Method 239.2. This NPDES-approved method utilizes atomic

absorption as the determinative technique to measure lead. Its nominal quantitation limit of 0.005 mg/L is expressed in the method as the lower limit of the measurement range.¹¹

The industry-supplied lead data included results that were lower than the baseline value. EPA used these values as reported in calculating the long-term averages and variability factors. Before using the long-term averages to calculate the proposed limitations and standards, EPA compared the long-term averages to the baseline value of 0.05 mg/L for lead (see Section 4.5.2). Because the calculated long-term averages were less than the baseline value, EPA used the baseline value instead of the calculated long-term averages in developing the proposed lead limitations and standards.

4.5.6 Method 245.1 (Mercury)

In developing the proposed limitations and standards for mercury, EPA included industry-supplied data from Method 245.1. This NPDES-approved method utilizes cold vapor atomic absorption as the determinative technique to measure mercury. Its nominal quantitation limit of 0.0002 mg/L is expressed in the method as the lower limit of the measurement range¹²

The industry-supplied mercury data included results lower than the baseline value (see Section 4.5.2). EPA used these data as reported in calculating the long-term averages and variability factors. Before using the long-term averages to calculate the proposed limitations and standards, EPA compared the long-term averages to the baseline value for mercury. None of the long-term averages were less than the baseline value.

4.5.7 Method 3120B (Chromium and Hexavalent Chromium)

Industry-supplied results for chromium and hexavalent chromium were determined by Method 3120B, an inductively coupled plasma (ICP) method. Its nominal quantitation limit of 0.01 mg/L is cited in the method as the lower limit of the measurement range.

Method 3120B is NPDES-approved for chromium determination and EPA included these data in calculating the chromium limitations and standards. (As described in Section 4.5.2, EPA used Method 1620 to determine chromium in the samples it collected.) None of the chromium data from Method 3120B had quantitated values or sample-specific quantitation limits lower than the baseline value of 0.01 mg/L (see Section 4.5.2).

Because of EPA's concerns about the quality of the hexavalent chromium measurements from Method 3120B, EPA excluded them when developing the proposed limitations and standards. Method 3120B is used for determination of total metals (including chromium), but is not typically used for hexavalent chromium determination. It is technically possible to analyze for hexavalent chromium by this method if, during sample preparation, the

¹¹This method refers to the lower value of the "optimum concentration range."

¹²This method calls it a detection limit.

hexavalent chromium is separated from other forms of chromium (i.e., Cr^{+3}). For the final rule, EPA will reevaluate its decision to exclude these data pending a full review of the laboratory reports (if industry provides them to EPA) to determine if the appropriate procedures were followed, and to determine if all quality assurance/quality control (QA/QC) criteria were met. The industry-supplied data from Method 3120B included quantitated values or sample-specific quantitation limits lower than the baseline value for hexavalent chromium (see Section 4.5.4). If EPA determines that it is appropriate to use these data in calculating the limitations and standards, EPA will use the quantitated values or sample-specific quantitation limits as reported. However, before using the long-term averages to calculate the limitations and standards, EPA will compare the long-term averages to the baseline value. If any long-term average is less than the baseline value, then EPA will use the baseline value in calculating the limitations and standards.

4.5.8 Method 3130B (Lead, Zinc)

Method 3130B was used to determine lead and zinc in some industry-supplied data. Method 3130B is an anodic stripping voltammetry (ASV) method that does not require sample digestion. EPA has excluded these data in developing the proposed rule for three reasons. First, EPA must still determine whether samples were acid digested. EPA requires acid digestion of samples for determination of total lead and zinc to ensure that lead and zinc complexes are broken down to a detectable form, and to reduce analytical interferences. Second, EPA must determine whether the results are associated with acceptable laboratory and matrix QA/QC. Finally, as there are no NPDES-approved ASV methods for the determination of lead or zinc in wastewater, EPA must assess if the application of the ASV method to wastewater effluents analyzed was appropriate (i.e., not subject to substantial interferences).

EPA will reconsider its decision to exclude data if and when industry provides the associated laboratory reports and QA/QC data. If review of the reports and QA/QC data shows that proper digestion was performed, that the method was in control, and that the method was successfully applied to the effluents, EPA may use the data in developing the final rule.

The industry-supplied data from Method 3130B included quantitated values or sample-specific quantitation limits lower than the baseline value for zinc (see Section 4.5.2). If EPA determines that it is appropriate to use these data in calculating the limitations and standards, EPA will use the quantitated values or sample-specific quantitation limits as reported. However, before using the long-term averages to calculate the limitations and standards, EPA will compare the long-term averages to the baseline value. If any long-term average is less than the baseline value, then the baseline value will be used rather than the long-term average.

4.5.9 Method 335.2 (Total Cyanide)

EPA and industry determined total cyanide using Method 335.2, which is an NPDES-approved method for determining total cyanide. Industry also used Method 4500 CN-E to determine total cyanide.

The nominal quantitation limit for Method 335.2 is expressed in the method as the lower limit of the measurement range.¹³ Because EPA used Method 335.2, the Agency used its nominal quantitation limit of 0.02 mg/L as the baseline value for all total cyanide results. Although some laboratories have demonstrated that they can quantitate to lower levels, none of the total cyanide data determined from Method 335.2 had quantitated values or sample-specific quantitation limits lower than the baseline value.

For total cyanide, industry also used the NPDES-approved 4500-CN procedures for sample analysis. In the listings of data for the proposal, EPA has identified this procedure with three different references provided by industry: 4500-CNC; 4500 CN E; and 4500-CNE. Method 4500-CNC refers to the distillation process used to prepare samples for analysis and Methods 4500 CN E and 4500-CNE refer to the colorimetric method of cyanide determination. EPA compared the data determined from these analyses to the baseline value of 0.02 mg/L associated with the nominal quantitation limit from Method 335.2. These values were used as reported in calculating the long-term averages and variability factors. Before using the long-term averages to calculate the proposed limitations and standards, EPA compared the long-term averages to the baseline value. None of the long-term averages were less than the baseline value.

4.5.10 Method 340.2 (Fluoride)

For samples collected by EPA, fluoride was determined by Method 340.2, an NPDES-approved potentiometric method that uses a fluoride electrode. Industry did not supply any additional data for this analyte. The nominal quantitation limit of 0.1 mg/L for Method 340.2 is expressed in the method as the lower limit of the measurement range,¹⁴ and was used as the baseline value for fluoride. None of the fluoride data had quantitated values or sample-specific quantitation limits lower than the baseline value.

4.5.11 Methods 350.2, 417/350.2, and 4500-NH₃ (Ammonia as Nitrogen)

For EPA's sampling episodes, ammonia as nitrogen was determined by Method 350.2. Industry also supplied data determined by Methods 417/350.2 and 4500-NH₃. In developing the proposed limitations and standards, EPA also included industry-supplied data for which industry did not identify the analytical methods used.

Method 350.2 uses either colorimetric, titrimetric, or electrode procedures to measure ammonia, and has a lower measurement range limit of 0.05 mg/L for the colorimetric and electrode procedures and 1.0 mg/L for the titrimetric procedure. Rather than use different baseline values, EPA used 0.05 mg/L because it represented a value at which ammonia as N can be reliably measured by several determinative techniques in Method 350.2, as well as in other 40

¹³The method states that is "sensitive to about 0.02 mg/L for the colorimetric procedure; the titrimetric procedure is used for measuring concentrations above 1 mg/L," so these do represent the lower limit of the measurement range.

¹⁴The method states that "Concentrations from 0.1... may be measured."

CFR 136 approved methods.¹⁵ None of the ammonia-as-nitrogen data had quantitated values or sample-specific quantitation limits lower than the baseline value.

One facility supplied concentration data and reported the method as ‘417/350.2.’ Based on additional information received from the facility, the method utilized is equivalent to NPDES-approved Method 350.2; therefore, EPA included these data in developing the proposed limitations and standards.

Some facilities used the 4500-NH₃ procedure. In the listings of data for the proposal, EPA has identified this procedure in four different ways: 4500-NH₃; 4500NH, BE; 4500NH₃-E; and 4500-NH₃F. With the exception of Method 4500-NH₃, which is a general method citation applicable to a group of specific methods, all these citations refer to 40 CFR 136 approved procedures for ammonia as nitrogen. 4500-NH₃-B refers to the primary distillation step performed prior to analysis. 4500-NH₃-E refers to the ammonia-selective electrode determinative technique, and 4500-NH₃-F refers to the spectrophotometric determination of ammonia by reaction with phenate. For the final rule, EPA will verify that approved techniques were utilized for the data identified only as Method 4500-NH₃.

EPA compared the data determined by these three methods to the baseline value of 0.05 mg/L that was derived from Method 350.2 because this is the method associated with EPA’s sampling episodes. None of the ammonia-as-nitrogen data had quantitated values or sample-specific quantitation limits lower than the baseline value.

4.5.12 Methods 353.1, 353.2, and 353.3 (Nitrate/Nitrite)

The preamble to the proposed rule solicits comments on whether nitrate/nitrite should be regulated. Nitrate/nitrite can be determined by three EPA methods, each of which lists slightly different nominal quantitation limits which are expressed in the methods as the lower limit of the measurement range. Methods 353.1 and 353.2 are automated colorimetric procedures with quantitation limits of 0.01 and 0.05 mg/L, respectively. Method 353.3 is a cadmium reduction, spectrophotometric procedure with a nominal quantitation limit of 0.01 mg/L. If EPA determines that regulation of nitrate/nitrite is necessary, it intends to use the Method 353.1 quantitation limit of 0.01 mg/L as the baseline value. Before using the long-term averages to calculate the limitations and standards, EPA will compare the long-term averages to the baseline value. If any long-term average is less than the baseline value, then EPA will use the baseline value rather than the long-term average in calculating the limitations and standards.

4.5.13 Methods 4500-CN M and D4374-98 (Thiocyanate)

Because no NPDES-approved method exists for thiocyanate, EPA is proposing two consensus standards, Method 4500-CN M (Standard Methods for the Examination of Water

¹⁵To demonstrate compliance, facilities are required to use analytical methods that are capable of measuring the concentration levels required by the promulgated limitations and standards.

and Wastewater, 20th Edition, 1998) and D4374-98 (Annual Book of ASTM Standards, Volume 11.02, 1999). In the preamble to the proposed rule, EPA solicits comments on these standards and, specifically, invites the public to identify additional potentially applicable voluntary consensus standards and to explain why such standards should be used to measure thiocyanate. For the data used to calculate the proposed limitations and standards, EPA and industry used the 4500-CN M procedure in determining the concentrations. EPA has not collected data to calculate the proposed limitations for thiocyanate by ASTM Method D4374-98. Because it wishes to provide facilities with additional options for test methods, EPA solicits comments on this method. Method D4374-98 is an automated procedure that has been shown to generate reliable results, with the added advantage of potentially eliminating more interferences than other methods from sample matrices.

In the listings of the data used to calculate the proposed limitations and standards, EPA has identified this method in three ways: 4500-CN; 4500-CN M.; and 4500CN-M. EPA has confirmed that the associated data were all generated by Method 4500-CN M. The nominal quantitation limit for Method 4500-CN M is cited in the method as the lower limit of the measurement range.¹⁶ Because EPA used Method 4500-CN M, the Agency used its nominal quantitation limit of 0.1 mg/L as the baseline value for all thiocyanate results. None of the thiocyanate data had quantitated values or sample-specific quantitation limits lower than this baseline value.

4.5.14 Method 625 (Naphthalene)

In developing the proposed limitations and standards for naphthalene, EPA included industry-supplied data from Method 625. This is an NPDES-approved GC/MS method for semivolatile organics. Its nominal quantitation limit is expressed as the lower limit of the measurement range, typically the concentration of the lowest calibration standard. EPA selected 0.01 mg/L as the baseline value based on the minimum level for Method 1625 (see Section 4.5.1).

The industry-supplied naphthalene data included quantitated values or sample-specific quantitation limits lower than the baseline value. EPA replaced these data with the value of the baseline value and assumed that the measurements were nonquantitated in developing the limitations and standards.

4.5.15 Method 8270 (Benzo(a)pyrene)

Industry supplied benzo(a)pyrene data generated from Method 8270 that is not approved for NPDES compliance monitoring. EPA recognizes that a number of similarities exist between Method 8270 and NPDES-approved methods. The estimated quantitation limit of 10 ug/L for benzo(a)pyrene in Method 8270 is the same as Method 1625's ML, which is also the basis for the baseline value for this analyte. Many of the QC checks and procedures of Method 8270 are analogous to procedures utilized by the approved NPDES methods, Method 625 in

¹⁶The method lists this value as the lower limit under "application" in natural waters or wastewaters.

particular. However, one major drawback for Method 8270 is that it only requires a subset of target analytes to be evaluated in the matrix spike, while Method 625 requires a full target analyte matrix spike. Furthermore, the calibration requirement in Method 8270 could be interpreted to mean that the calibration standard should be at or below the known or anticipated regulatory compliance level.

Because of the reasons expressed above, EPA has concerns about the quality of the benzo(a)pyrene data generated by Method 8270. Consequently, EPA excluded them from developing the proposed limitations and standards. For the final rule, EPA will reconsider using these data pending a full review of the laboratory reports (if industry provides them to EPA) including initial precision and recovery (IPR) analyses, instrument tunes, calibrations, blanks, laboratory control sample (LCS) analyses, matrix spikes, surrogates, and all sample data. EPA will review any submitted calibration data to confirm that the GC/MS was calibrated at the ML of 10 ug/L, thereby demonstrating that reliable measurements could be made to this level. EPA will also evaluate the data to determine if appropriate extraction and cleanup procedures were used in analyzing the samples.

The industry-supplied data from Method 8270 included quantitated values or sample-specific quantitation limits lower than the baseline value. If EPA determines that it is appropriate to use these data in calculating the limitations and standards, EPA may replace these data with the value of the baseline value and assume that the measurements are nonquantitated.

4.5.16 Methods 330.1, 330.2, 330.3, 330.4, 330.5 (Total Residual Chlorine)

The proposed limitations and standards for total residual chlorine are based upon limitations and standards developed during the 1982 Iron and Steel rule. The term “total residual chlorine” is used interchangeably with “chlorine” and, in aqueous samples, represents a measure of both free and combined chlorine that is present in the sample.

To comply with the proposed limitations and standards, a facility will be required to use an NPDES-approved method such as Method 330.1, 330.2, 330.3, 330.4, or 330.5 to ensure that it implemented appropriate analytical protocols.

If EPA collects or the industry supplies appropriate data from the model technologies prior to promulgation of the final rule, EPA will compare the long-term average to the baseline value of 0.1 mg/L derived from the quantitation limits in Methods 330.3 and 330.4. If any values are less than the baseline value, they will be used as reported. However, EPA will compare the baseline value to the long-term averages used in calculating the final limitations and standards. If any long-term average is less than the baseline value, the baseline value will be used for purposes of calculating the limitations and standards.

4.6 References

- 4-1 U.S. Environmental Protection Agency. Methods for Chemical Analysis of Water and Wastes. EPA 821-C-99-004. Washington, D.C., June 1999.
- 4-2 American Public Health Association, American Water Works Association, and Water Environment Federation. Standard Methods for the Examination by Water and Wastewater, 20th Edition. Washington, D.C., 1998.

Table 4-1**Analytical Methods and Baseline Values**

Analyte	Chemical Abstract Service (CAS) Number	Baseline Value (mg/L)	Samples Collected and Analyzed by	Method Used to Analyze Samples	Nominal Quantitation Value (mg/L) for Method	Assumption for Reported Values ^a < Baseline Value (BV)
Ammonia as Nitrogen	7664417	0.05	EPA, Industry	350.2	0.05	All ≥ BV
			Industry	417/350.2	0.05	All ≥ BV
				4500-NH ₃	0.1 ^b	All ≥ BV
				4500-NH ₃ F	0.1	All ≥ BV
				4500NH, BE	0.8	All ≥ BV
				4500NH ₃ -E	0.8	All ≥ BV
				NA	NA	All ≥ BV
Fluoride	16984488	0.1	EPA	340.2	0.1	All ≥ BV
Hexane Extractable Material (HEM)	C036	5	EPA	1664	5	All ≥ BV
Nitrate/Nitrite	C005	0.01	^c	353.1	0.01	^c
Thiocyanate	302045	0.1	EPA	4500-CN	0.1	All ≥ BV
			EPA	4500-CN M.	0.1	All ≥ BV
			Industry	4500CN-M	0.1	All ≥ BV
			Proposed	D4374-98	0.0001	See §4.5.13
Total Cyanide	57125	0.02	EPA, Industry	335.2	0.02	All ≥ BV
			Industry	4500 CN E	.005	All ≥ BV
				4500-CNC	.005 ^d	All ≥ BV
				4500-CNE	.005	Used as reported
Total Residual Chlorine	7782505	0.1	^e	330.1 - 330.5	0.1 ^f	^e
Total Suspended Solids (TSS)	C009	4	EPA, Industry	160.2	4	All ≥ BV
			Industry	160.2	4	Used as reported
				209C	4	Used as reported
				2540 D	4	All ≥ BV
				NA	NA	Used as reported
Chromium	7440473	0.01	EPA	1620	0.01	Used as reported
			Industry	200.7	0.01	Used as reported
				3120B	0.01	All ≥ BV
				NA	NA	All ≥ BV
Hexavalent Chromium	18540299	0.01	EPA	218.4	0.01	All ≥ BV
			Industry	3120B	NI	Excluded data
				NA	NA	All ≥ BV

Table 4-1 (Continued)

Analyte	Chemical Abstract Service (CAS) Number	Baseline Value (mg/L)	Samples Collected and Analyzed by	Method Used to Analyze Samples	Nominal Quantitation Value (mg/L) for Method	Assumption for Reported Values ^a < Baseline Value (BV)
Lead	7439921	0.05	EPA	1620	0.05	Used as reported
			Industry	200.7	0.05	Used as reported
				239.2	0.005	Used as reported
				3130B	NI	Excluded data
Mercury	7439976	0.0002	EPA	1620	0.0002	Used data as reported
			Industry	245.1	0.0002	All \geq BV
Nickel	7440020	0.04	EPA	1620	0.04	Used as reported
			Industry	200.7	0.04	Used as reported
				NA	NA	Used as reported
Selenium	7782492	0.005	EPA	1620	0.005	All \geq BV
Zinc	7440666	0.02	EPA	1620	0.02	Used as reported
			Industry	200.7	0.02	Used as reported
				3130B	NI	Excluded data
Benzo(a)pyrene	50328	0.01	EPA	1625	0.01	Used as reported
			Industry	8270	0.01	Excluded data
Naphthalene	91203	0.01	EPA	1625	0.01	All \geq BV
			Industry	625	0.01	Modified to BV
Total Phenol	108952	0.01	EPA	1625	0.01	All \geq BV
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207319	10 pg/L	EPA	1613B	10 pg/L	All \geq BV

NA - The facility did not provide the specific analytical method. However, because the data were collected at the sampling points specified for compliance monitoring, EPA assumed that the methods would have been NPDES-approved methods that facilities are required to use for compliance monitoring.

NI - EPA needs information from the facility about the laboratory analysis.

^aIf the entry in this column indicates that EPA "used as reported" for a particular analyte, then EPA used either the quantitated value or the sample-specific quantitation limit reported by the laboratory.

^bFor some of the industry-submitted data, "4500-NH₃" was cited as the method used. This reference is vague in that it potentially refers to seven different procedures. Consequently, EPA has listed the lowest of the measurement ranges cited in the methods.

^cEPA is soliciting comment on whether nitrate/nitrite should be regulated (see Section IX.G.2.a in the preamble to the proposed rulemaking). EPA used data sources other than its sampling episodes as a basis for evaluating this pollutant. If EPA decides to regulate this pollutant, Method 353.1 is likely to be the basis of the baseline value used in calculating the final limitations and standards for nitrate/nitrite.

^dMethod 4500-CN-C is the distillation process by which to prepare samples for analysis by either 4500-CN-D or -E. Because EPA does not have complete information on which determinative technique industry used, the quantitation limit reflected in the citation for 4500-CN-C is the lower quantitation limit of the two procedures.

^eEPA is proposing effluent limitations and standards for total residual chlorine based upon data from the 1982 rule (see Section 12.2.1.1 for further discussion). In measuring for total residual chlorine in its sampling episodes for the final rule, EPA intends to use Methods 330.1 - 330.5.

^fBaseline value and nominal quantitation limit are based on capabilities of approved EPA methods.

SECTION 5

DESCRIPTION OF THE INDUSTRY

The United States is the third largest steel producer in the world with 12 percent of the market, an annual output of approximately 105 million tons per year, and nearly 145,000 employees. The iron and steel rule would apply to approximately 254 iron and steel sites. The 254 sites are owned by 115 companies, as estimated by the EPA survey. The global nature of the industry is illustrated by the fact that 18 companies have foreign ownership. Twelve other companies are joint entities, with at least one U.S. company partner. Excluding joint entities and foreign ownership, 85 are U.S. companies, more than half of which are privately owned.

This section describes the iron and steel industry, including types of sites and the manufacturing operations performed. All estimates included in this section represent 1997 data.

5.1 Types of Sites

For purposes of the proposed rule, EPA classified manufacturing facilities in the iron and steel industry into three groups on the basis of raw material consumption and manufacturing processes: integrated steel mills, non-integrated steel mills, and stand-alone facilities. Integrated and non-integrated mills produce molten steel by different methods. Stand-alone facilities include certain raw material preparation facilities and steel forming and finishing mills. Stand-alone facilities do not produce molten steel.

Integrated steel mills produce molten iron in blast furnaces using coke, limestone, beneficiated iron ore, and preheated air as the principal raw materials. Other raw materials may include sinter, other iron-bearing materials, oxygen, and alternate sources of carbon. These mills charge molten iron (or hot metal) and steel scrap to basic oxygen furnaces (BOFs) to produce molten steel. Depending on final product specifications, the molten steel then undergoes various refining steps prior to casting, hot forming, and finishing operations. Several integrated mills also have cokemaking and sintering plants that produce raw materials for blast furnace operations. There are 20 integrated steel mills located in the United States that account for approximately 60 percent of annual raw steel production.

Non-integrated steel mills produce molten steel by melting steel scrap in electric arc furnaces (EAFs). Some non-integrated steel mills also use high-quality iron materials such as pig iron or direct reduced iron with scrap. As at integrated mills, the molten steel undergoes various refining, casting, hot forming, and finishing operations. There are about 94 non-integrated steel mills located in the United States that account for approximately 40 percent of annual raw steel production.

Figure 5-1 shows the steelmaking, refining, and casting operations that occur at integrated and non-integrated steel mills. Figure 5-2 shows the various hot forming and finishing operations that steel may undergo to form semi-finished or finished products.

Stand-alone mills that do not produce molten steel conduct many of the hot forming and steel finishing operations conducted at integrated and non-integrated steel mills. A number of stand-alone operations produce raw materials for ironmaking and steelmaking (e.g., by-product and non-recovery coke plants, sinter plants, and direct reduced iron plants). There are approximately 138 different types of stand-alone facilities located in the United States, described below:

- Coke plants and sinter plants manufacture feed materials for blast furnaces.
- Direct reduced ironmaking plants manufacture feed materials for electric arc furnaces.
- Stand-alone hot forming mills receive cast products from integrated and non-integrated steel mills. These facilities perform hot forming operations and, depending on the product, a limited number may perform steel finishing operations.
- Finishing operations include acid pickling and descaling, cold rolling and annealing, acid and alkaline cleaning, and coating operations such as electroplating and hot coating. Stand-alone carbon steel finishing mills may perform acid pickling, cold rolling and annealing, acid and alkaline cleaning, electroplating, and hot coating on carbon steel products received from other mills. Stand-alone stainless steel finishing mills typically perform acid pickling and descaling and cold rolling and annealing operations on stainless steel products received from other mills.
- Stand-alone pipe and tube mills include:
 - Facilities that manufacture butt-welded or seamless pipe and tube through hot forming operations,
 - Facilities that manufacture pipe and tube using other operations such as electric resistance welding, and
 - Facilities that receive pipe and tube and perform other operations, such as drawing.

Only the stand-alone pipe and tube mills that manufacture butt-welded or seamless pipe and tube through hot forming operations are included in the proposed regulation for the Iron and Steel Category.

Table 5-1 presents EPA's national estimates of the types of iron and steel sites in the United States. Non-integrated steel mills outnumber integrated steel mills by more than four to one. Stand-alone finishing facilities form the second largest group, and stand-alone hot forming facilities form the third largest group. This reflects two trends in the industry over the

past 25 years - a shift of steel production from older, larger integrated steel mills to newer, smaller non-integrated steel mills, and the emergence of specialized, stand-alone finishing facilities that process semi-finished sheet, strip, bars, and rods obtained from integrated or non-integrated facilities.

Integrated steel mills are primarily located east of the Mississippi River in Illinois, Indiana, Michigan, Ohio, Pennsylvania, West Virginia, Maryland, Kentucky, and Alabama; one integrated steel mill is located in Utah. Figure 5-3 shows the locations in the United States of integrated steel mills. Stand-alone coke plants and those at integrated steel mills are located in Illinois, Indiana, Michigan, Ohio, New York, Pennsylvania, Virginia, Kentucky, Alabama, and Utah. Figure 5-4 shows the locations in the United States of stand-alone and colocated coke facilities. Non-integrated steel mills are located throughout the continental United States, as are stand-alone hot forming and finishing mills.

For purposes of the proposed iron and steel rule, EPA classified steel produced at integrated and non-integrated steel mills as carbon steels, alloy steels, and stainless steels. Carbon steels owe their properties to varying concentrations of carbon, with relatively low concentrations of alloying elements (i.e., less than 1.65 percent manganese, 0.60 percent silicon, 0.60 percent copper). Alloy steels contain concentrations of manganese, silicon, or copper greater than those for carbon steels, or other specified alloying elements added to impart unique properties to the steel. Stainless steels are a subset of alloy steels that are corrosion resistant and heat resistant. The principal alloying elements are chromium, nickel, and silicon. Industry practice is to call steels stainless when the chromium content is 10 percent or greater.

Table 5-2 lists the types of steels manufactured or processed at integrated and non-integrated steel mills and stand-alone hot forming, finishing, and pipe and tube mills, as reported in industry surveys. All integrated steel mills produce carbon steels. Some also produce alloy steels and process stainless steels. Based on industry survey responses, 56 of the 66 surveyed non-integrated steel mills, 14 of the 17 surveyed stand-alone hot forming mills, and 28 of the 38 surveyed stand-alone finishing mills produce or process carbon steels.

Steel mills may discharge wastewater directly to surface water (direct discharge), to publicly owned treatment works (POTWs) (indirect discharge), or not at all (zero or alternative discharge). Table 5-3 shows the discharge status of integrated and non-integrated steel mills and stand-alone facilities that would be subject to a revised 40 CFR Part 420. A single mill may discharge process wastewater from one operation directly to surface waters and from another operation indirectly to a POTW. All but one integrated mill are direct dischargers; two discharge both directly and indirectly. The Agency's national estimate for non-integrated steel mills is, out of 94 mills, 46 are direct dischargers, 32 are zero or alternative dischargers, and 19 are indirect dischargers. For the 70 stand-alone finishing mills, the Agency national estimate is 34 indirect dischargers, 28 direct dischargers, and 11 zero or alternative dischargers.

5.2 Manufacturing Operations

The following subsections describe the types of manufacturing operations performed at integrated and non-integrated steel mills and stand-alone iron and steel facilities. Information presented includes production and capacity, wastewater generation, discharge destinations, and discharge type. Table 5-4 presents the various manufacturing operations, the national estimate of sites for each type of operation, the national estimate of production, and the national estimate of production capacity by operation.

5.2.1 Cokemaking

Blast furnaces use carbon in the form of metallurgical coke to reduce iron oxides to metallic iron. Foundries also use metallurgical coke for similar purposes. There are two types of coke plants operated in the United States: (1) the traditional by-product recovery coke plant, in which coke, coke oven gas, and several chemical by-products are derived from coal; and (2) non-recovery or heat recovery coke plants, in which the only by-product is heat, which is used to generate steam and electric power. There are 24 by-product recovery coke plants and two non-recovery coke plants located in the United States. By-product recovery plants produce approximately 90 percent of the coke. Coke used for blast furnace operations is called *furnace coke*, while coke used for foundry operations is called *foundry coke*. Presently, foundry coke is produced only in by-product coke plants, whereas furnace coke is produced in both by-product recovery and non-recovery coke plants. Of the 24 coke plants, 19 primarily produce blast furnace coke, four primarily produce foundry coke, and one routinely produces both.

By-Product Recovery Coke Plants

By-product recovery coke plants comprise coal handling and preparation facilities, one or more coke batteries (i.e., groups of 40 or more vertical, slot-type coke ovens located side by side) equipped with coal charging and coke pushing equipment, coke oven gas collection and cleaning facilities, by-product recovery systems, coke quenching stations, and associated air and water pollution control facilities and solid waste processing operations.

Blends of high-, low-, and medium-volatile coals and other carbonaceous materials such as petroleum coke are pulverized and screened to desired size (e.g., > 80 percent, minus 1/8 inch) and charged into the tops of coke ovens with charging machines called larry cars. The ovens are operated on a sequential batch basis. The ovens are positive pressure ovens in which the coal charge is heated in the absence of air to drive off volatile materials and water to leave the carbonaceous residue called coke. Different blends of coals are used to produce foundry coke. The coking time is approximately 16 hours for furnace coke and typically 28 to 30 hours for foundry coke. Coking temperatures in the ovens range from approximately 1,650 to 2,000°F.

When the coking cycle is completed, the oven doors are removed and the incandescent coke is pushed from the oven into a rail car called a coke quench car. Plants usually control air emissions from pushing operations with baghouses or wet scrubbers. The quench car is positioned under a quench station where large volumes of water quench the coke to halt further

combustion. All United States coke plants recycle and evaporate to extinction coke quench water. Make-up water for coke quenching stations is typically plant service water (i.e., the plant's water supply). The coke is then sized and stored for future use. Relatively fine coke particles collected in quench station sumps are called coke breeze. Coke breeze is used as a charge material for production of foundry coke, for sinter plant operations, or sold for other uses.

Coke oven gas from the coke ovens is scrubbed in gas collector mains located on top of the coke battery with a fluid called flushing liquor, to condense tars and moisture derived from the coal. The flushing liquor is processed in tar decanter tanks that essentially use gravity to separate tar from the flushing liquor stream. Flushing liquor is recycled to the collector mains at a high rate. Excess flushing liquor, also called waste ammonia liquor, comprises principally the moisture in the coal charged to the coke ovens. Excess flushing liquor is rejected from the flushing liquor circuit and is the principal process wastewater stream generated at by-product coke plants. Sludge collected at the bottom of the tar decanters is a listed hazardous waste and is typically mixed with coke breeze and other carbonaceous material and recycled to the coke ovens with the coal charge. Crude coal tars collected from the tar decanters is typically stored in tanks on site and sold as a by-product.

The coke oven gas is further processed to remove additional materials that are also sold as by-products. Primary gas coolers and tar precipitators remove additional tars. Scrubbing the gas with sulfuric acid to produce ammonium sulfate removes ammonia, and scrubbing it with a recirculated wash oil solution removes light oil (an unrefined oil rich in benzene, toluene, xylene, and solvent naphthas). The collected tars and naphthalene from final gas cooling operations are typically mixed with coal tars recovered from tar decanters and sold with the tars. Many by-product recovery coke plants have coke oven gas desulfurization systems that recover sulfur removed from the coke oven gas as elemental sulfur. Ammonia is also steam stripped from the excess flushing liquor and returned to the coke oven gas before the gas is scrubbed with sulfuric acid.

The by-product recovery cokemaking industry uses a variety of chemical processing technologies to recover materials such as crude coal tar, crude light oil (e.g., aromatics, paraffins, cycloparaffins and naphthenes, sulfur compounds), anhydrous ammonia or ammonium sulfate, naphthalene, and sodium phenolate. These technologies include:

- *Crude coal tar recovery.* Coal tar from the flushing liquor and primary coolers is collected for resale or further processing on or off site. By-products recovery coke plants recover crude coal tar in tar decanters.
- *Crude light oils recovery.* Light oils are scrubbed from the coke oven gas, recovered for resale, reused as a solvent for phenolics, or sent for further refining on or off site.
- *Recovery of ammonia and ammonia compounds.* Free ammonia is commonly steam stripped from waste ammonia liquors. A number of sites remove fixed ammonia by elevating the pH of the wastewater with lime

slurry or caustic soda solutions. The liberated ammonia is combined with coke oven gas (COG) and removed with ammonia contained in the COG with sprays of sulfuric acid or phosphoric acid in an absorber, or by scrubbing ammonia from gas with fresh water, which is recirculated to produce concentrated ammonium hydroxide.

- *Recovery of phenol, phenolates, and carbolates.* Vapor recirculation or liquid/liquid extraction with suitable solvents removes and recovers phenolic compounds. In vapor recirculation, the steam leaving the free leg of the ammonia still is scrubbed with dilute caustic soda to form sodium phenolate. This steam recirculates to the ammonia stills for further treatment and recovery. In liquid/liquid extraction, the benzol, light oil, or other suitable solvent extracts phenolic compounds from the wastewater. The phenolized solvent is separated and extracted with caustic. Again, sodium phenolates separate out, and the phenolized solvent is reused in the recovery system.
- *Recovery of sulfur and sulfur compounds.* Desulfurization systems recover elemental sulfur or sulfur compounds from COG. Techniques developed include iron oxide boxes using Fe_2O_3 on wood shavings, absorption and desorption with soda ash, Wilputte vacuum carbonate systems, Seaboard actified solution systems, and Claus sulfur recovery systems.
- *Naphthalene.* Crystals of naphthalene are condensed in the final cooler and recovered from the recirculating final cooler wastewater by skimming, filtration, or centrifugation. Naphthalene may be recovered by solidification at temperatures below 74°C (165°F).

Non-Recovery Coke Plants

Non-recovery coke plants carbonize coal in large dome-shaped oven chambers. Volatile components evolved from the coal are partially combusted in the oven chamber, thus providing some of the heat for coking. The gas is also used to underfire the ovens. Heat in the waste gases is partially recovered in waste heat boilers to generate steam, which can be used for electric power generation or for other uses. Because non-recovery plants combust all materials evolved from the coal, there are no by-products recovered other than heat in the waste gases and coke breeze. The pushing and quenching operations are similar to those performed at by-product recovery coke plants.

5.2.2 Sintering

Sintering is an agglomeration process in which iron-bearing materials (generally fines) are mixed with iron ore, limestone, and finely divided fuel such as coke breeze. During iron and steel production operations, blast furnaces, basic oxygen furnaces, continuous casters, and hot forming mills generate large quantities of particulate matter (e.g., fines, mill scale, flue dust,

wastewater sludge). Mills remove the particulate matter from process gases by dry or wet air pollution control devices to reduce air emissions or to clean the gases for reuse as fuel. Sintering operations recover mill scale from process wastewater discharged from continuous casting and hot forming operations. These operations can recover a large percentage of this iron-rich material, provided the oil content is low enough to prevent objectionable fumes.

Sinter plants consist of raw material handling facilities and raw material storage bins, sinter strand (traveling grate combustion device), a mixing drum for each sinter strand, a windbox (draws air through the traveling grate), a discharge end, and a cooling bed for sintered product. The particulate matter is mixed in sinter machines and charged to the traveling grate at a depth of approximately one foot. The mixture is ignited, and air is drawn through the bed as it travels toward the discharge end to promote combustion and fusing of the iron-bearing materials. The sinter product serves as a supplementary raw material for blast furnace operations.

Out of the nine sinter plants operating in 1997, seven operate wet air pollution control systems and eight operate dry air pollution control systems. Since 1997, one facility with wet air pollution controls has been shut down on an indefinite basis.

5.2.3 Briquetting

Briquetting is another agglomeration process used to recycle and reuse fine materials that otherwise could not be charged to blast furnaces or steelmaking furnaces. The operation forms materials into discrete shapes of sufficient size, strength, and weight for charging to a subsequent process (e.g., blast furnaces, BOFs). Materials can be similar to those charged to sintering operations. Briquetting operations can be performed with or without heating the raw materials, and do not generate process wastewater.

5.2.4 Blast Furnace Ironmaking

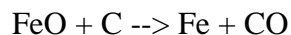
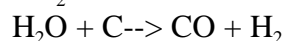
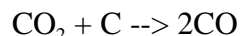
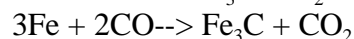
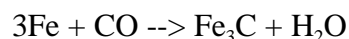
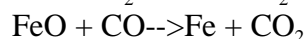
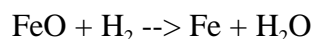
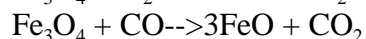
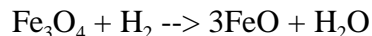
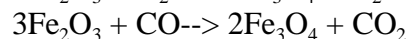
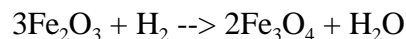
Blast furnaces produce molten iron, which makes up two-thirds to nearly three-quarters of the metallic charge to basic oxygen steelmaking furnaces; the balance is cold steel scrap. The blast furnace has several zones: crucible-shaped hearth (bottom of the furnace), intermediate zone called a bosh (between the hearth and the stack), a vertical shaft called the stack (between the bosh and top of furnace), and the furnace top, which contains the mechanism for charging the furnace. The hearth and bosh walls are lined with carbon-type refractory blocks, and the stack is lined with high-quality fireclay bricks. To protect these refractory materials from burning out, cooling water circulates through exterior plates, staves, or sprays. Blast furnace sizes range between 70 and 120 feet in height, with hearth diameters between 20 and 45 feet. The rated capacity of blast furnaces ranges from under one million tons per year to over four million tons per year.

The raw materials charged to the top of the blast furnace include coke, limestone, beneficiated iron ores or iron pellets, and sinter. Iron pellets, the dominant burden material (material charged to the furnace) in North America, include acid pellets and fluxed pellets, which are typically produced at or near iron ore mine sites. Coke supports the furnace burden. Iron-

bearing materials are reduced to molten iron and slag as they descend through the furnace. A continuous feed of alternating layers of coke, iron-bearing materials, and limestone are charged to the top of the furnace. Hot blast (preheated air) at temperatures between 1,650 and 2,300°F and injected fuel (e.g., pulverized coal, oil, natural gas) are blown into the bottom of the furnace (top of the hearth) through a bustle pipe and tuyeres (orifices) located around the circumference of the furnace. The preheated air reacts with the coke to produce the reducing agent, carbon monoxide. The reducing gases ascend through the furnace to react with the iron-bearing materials to produce the molten iron and slag. The limestone is a fluxing agent that forms the fluid slag, which combines with unwanted impurities in the ore. The molten iron, at approximately 2,800 to 3,000°F, accumulates in the hearth and is tapped at regular intervals into refractory-lined cars for transport to the steelmaking furnaces. Molten slag, which floats on top of the molten iron, is also tapped and processed for sale as a by-product.

Blast furnace slag uses include railroad ballast, aggregate in cement manufacturing, and other construction uses. There are 20 integrated steel mills with blast furnace operations in the United States.

Below is a simplified summary of the chemical reactions that occur in the blast furnace:



The hot blast exits the furnace top as blast furnace flue gas in enclosed piping. A combination of dry dust catchers and high-energy venturi scrubbers clean and cool the gas. Stoves combust the cleaned gas to preheat the incoming air and for use as fuel elsewhere in integrated mills. Direct contact water is applied in the gas coolers and high-energy scrubbers. All sites operating blast furnaces use wet air gas cleaning systems.

Blast furnace manufacturing operations may use wastewater or plant service water for slag cooling or quenching. Nineteen of the 20 integrated facilities surveyed use water for slag cooling at blast furnace operations.

5.2.5 Direct Reduced Ironmaking

Another method of producing iron is through direct reduction. This process produces relatively pure iron in solid pellet form by reducing iron at a temperature below the melting point of the iron produced. Direct reduced iron (DRI) is used as a substitute for scrap steel in EAF steelmaking to minimize contaminant levels in the melted steel and to allow economic steel production when market prices for scrap steel are high. There are two direct reduced ironmaking plants in the United States.

The prime ingredient in DRI is iron oxide ore. The DRI process removes the oxygen from the iron ore. The DRI process uses a slightly inclined rotating kiln, where the raw materials and heat are added. Raw materials include iron ore, coal, and recycled material. The heat may be supplied by oil or gas burners. One common DRI process uses natural gas as both an energy source and a reducing gas. The process involves blending oxide pellets and lump ores and charging this mixture to the top of the furnace. The top zone of the furnace is where reduction occurs and the bottom zone of the furnace is where cooling occurs. While in the furnace, the blended ore mixture is saturated with a reducing gas mixture of carbon monoxide and hydrogen, which is produced from the natural gas in gas reformers. This gas is preheated to a temperature of approximately 1,500°F. The descending iron ore pellets are reduced as they descend through the kiln. The oxide ore and the reducing gas remain in the furnace for several hours, resulting in direct reduced iron.

5.2.6 Steelmaking: Basic Oxygen Furnaces (BOFs) and Electric Arc Furnaces (EAFs)

Steelmaking in the United States is performed in either BOFs or EAFs. BOF and EAF processes are batch operations with tap-to-tap (batch cycle) times of about 45 minutes for BOFs and in the range of 1 to more than 1.5 hours for EAFs. BOFs typically produce high-tonnage carbon steels, while EAFs produce carbon steels and low-tonnage alloy and stainless steels.

Basic Oxygen Furnace (BOF)

The open hearth furnace process for steelmaking was replaced after World War II with the basic oxygen process (BOP). This process involves blowing oxygen through a lance into the top of a pear-shaped vessel. Lime addition to the charge removes phosphorus and sulfur impurities in the form of slag. Compared with the open hearth furnace, steelmaking using BOP became a much quicker process, with tap-to-tap times of approximately 60 minutes compared to 12 or more hours. In addition, up to 35 percent of the charge could be steel scrap.

After its invention, the BOP was modified. In addition to blowing oxygen directly onto the charge, the process involved also blowing burnt lime through the lance with the oxygen. This process allowed refining of pig iron smelted from high-phosphorus ores. The next process modification, developed in Canada and Germany in the mid-1960s, was the bottom-blown steelmaking process. This process used two concentric tuyeres, the outer with hydrocarbon gas and the inner with oxygen. This new process became known as Q-BOP. Both the BOP and Q-BOP process are types of BOF steelmaking which are used today.

The BOF steelmaking process refines the product of the blast furnace (hot metal), which contains approximately 3.5 to 4.4 percent carbon, ≤ 0.05 percent sulfur, and ≤ 0.04 percent phosphorus. In steelmaking operations, the furnace charge consists of approximately two-thirds molten iron and one-third scrap steel. The furnace melts the charge and refines it by oxidizing silicon, carbon, manganese, phosphorus, and a portion of the iron in the molten bath. Various alloying elements are added to produce different grades of steel. Common alloying elements include aluminum, boron, chromium, copper, magnesium, molybdenum, niobium, nickel, silicon, and vanadium.

Vessels used in the BOF process are generally vertical cylinders surmounted by a truncated cone. Typical heat sizes in BOFs range between under 100 tons per heat to over 300 tons per heat.

Scrap and molten iron are first placed in the vessel. Oxygen is then injected into the molten bath either through the top of the furnace (top blown), bottom of the furnace (bottom blown), or both (combination blown). A violent reaction occurs immediately, bringing the molten metal and hot gases into intimate contact, causing impurities to burn off quickly. Management of furnace slag processes controls residual sulfur. The slag is separated and removed from the molten steel. Finally, alloys are added to the bath or as the steel is tapped (poured) into ladles. Slag material is charged back to the blast furnace to recover iron or used as railroad ballast. The BOF allows close control of steel quality and the ability to process a wide range of raw materials.

Off-gases from BOFs exit the vessel at temperatures of approximately 3,000°F. This gas contains approximately 90 percent carbon monoxide and 10 percent carbon dioxide, and may also contain ferrous oxide dust. BOF off-gas control systems include two types: full or open combustion and suppressed combustion. The full combustion system burns the off-gas above the mouth of the vessel using excess air. Air pollution control systems then clean the off-gas. The suppressed combustion system lowers a ring-shaped hood over the vessel mouth, collecting the gases, which are used as heating sources.

Sites may operate wet, semi-wet, or both types of air pollution control systems at BOF processes. Fourteen of the 20 sites operating BOFs in 1997 used wet air pollution control, and eight used semi-wet air pollution control. United States facilities control off-gases from BOFs by one of three methods: semi-wet, wet-open, or wet-suppressed. In semi-wet combustion, BOF off-gases are conditioned with moisture prior to processing in electrostatic precipitators or bag houses. In wet-open combustion, excess air is admitted to the off-gas collection system, allowing carbon monoxide to combust prior to high-energy wet scrubbing. In wet-suppressed

combustion, excess air is not admitted to the off-gas collection system prior to high-energy wet scrubbing.

Similar to blast furnaces, BOF manufacturing operations may use wastewater or plant service water for slag cooling or quenching. Eighteen of the 20 integrated facilities surveyed use water instead of air for slag cooling in BOF operations.

Electric Arc Furnace (EAF)

The EAF is designed to produce specific grades of steel. The first EAFs developed in the late 1800s and early 1900s could melt approximately one ton per heat. Typical heat sizes in current EAFs range between under one ton per heat to over 350 tons per heat.

The furnace is a cylindrical vessel with a dish-shaped refractory hearth and three electrodes that lower from the dome-shaped, removable roof. Depending on heat sizes, shell diameters range from 8 feet for a 10-ton vessel to 30 feet for a 300-ton vessel. Tar-bonded magnesite bricks form the lining of the furnace. The walls typically contain water-cooled panels that are covered to minimize heat loss. The electrodes may also be equipped with water cooling systems.

The cycle in EAF steelmaking consists of scrap charging, melting, refining, deslagging, and tapping. In addition to scrap steel, the charge may include pig iron and alloying materials. As the steel scrap is melted, additional buckets of scrap may be added to the furnace. The EAF generates heat by passing an electric current between electrodes through the charge in the furnace. Lime-rich slag removes the steel impurities (e.g., silicon, sulfur, and phosphorus) from the molten steel. Oxygen may be added to the furnace to speed up the steelmaking process. At the end of a heat, the furnace tips forward and the molten steel is poured off. Non-integrated steelmaking facilities typically operate EAFs.

5.2.7 Vacuum Degassing

Vacuum degassing is a refining process in which gases are removed from molten steel under vacuum after steelmaking and prior to casting to produce steels of high metallurgical quality. Vacuum degassing may be used to control composition and temperature, remove oxygen (deoxidation) and hydrogen (degassing), decarburize, and otherwise remove impurities from the steel. Steam jet ejectors generate the vacuum for high-tonnage vacuum degassing units. The gases and water used to condense the steam come in direct contact in barometric condensers. While the molten steel is under vacuum, elements that have a relatively higher vapor pressure (such as manganese and zinc) volatilize and exit with the gases. Vacuum degassers are common at integrated and non-integrated mills that produce low carbon, stainless, and certain alloy steels. Vacuum degassers often operate as part of ladle metallurgy stations where additional steel refining is conducted. EPA estimates that 44 sites operate vacuum degassing systems.

5.2.8 Ladle Metallurgy and Secondary Steelmaking

Ladle metallurgy and secondary steelmaking are steel refining operations that molten steels undergo under atmospheric conditions (i.e., no vacuum is applied) prior to continuous or ingot casting. The purpose of ladle metallurgy and secondary steelmaking may include one or more of the following:

- To control gases in the steel;
- To remove, add, or adjust concentrations of metallic or nonmetallic compounds (alloying); and
- To adjust physical properties (e.g., temperature).

Common types of ladle metallurgy include argon or nitrogen bubbling or stirring, argon-oxygen decarburization, lance injection, magnetic stirring, and other alloy addition operations. Common types of secondary steelmaking include electroslag refining and other alloy addition operations. EPA estimates that 103 sites use ladle metallurgy and/or secondary steelmaking; some sites may operate more than one type of process. The following table lists the types of ladle metallurgy and secondary steelmaking performed at iron and steel sites in 1997.

**1997 National Estimate for Types of Ladle Metallurgy
and Secondary Steelmaking Processes**

Type of Ladle Metallurgy or Secondary Steelmaking	Number of Sites
Argon bubbling	66
Argon-oxygen decarburization	16
Electroslag remelting	10
Lance injection	19
Other ^a	37

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

^a Other types of ladle metallurgy include alloy addition, reheating, magnetic stirring, ladle stirring, and carbon addition/adjustment.

EPA estimates that only four of the 103 sites with ladle metallurgy and secondary steelmaking operations operate wet air pollution control systems.

5.2.9 Casting

An integral part of the steelmaking process is converting molten steel into a semifinished product or shape that is suitable for further processing. There are two main casting operation types: continuous and ingot casting. Molten steel is tapped from the BOF or EAF into ladles large enough to hold an entire heat. The ladles are then processed in ladle metallurgy stations and/or vacuum degassers prior to teeming (pouring) the steel into ingot molds or direct casting it into semi-finished shapes using continuous casters. EPA estimates that 113 sites operate casters.

Continuous Casting

Continuous casting is the most efficient and most common method of casting performed at steel mills. In the continuous casting process, molten steel is poured from the ladle into a refractory lined tundish (mold). The molten metal from the tundish pours through nozzles into an oscillating water-cooled copper mold, where the metal partially solidifies. The copper molds oscillate to prevent the molten steel from sticking to their sides. Lubricants spray into the molds to keep the steel moving through the mold. After passing through the water-cooled molds, the partially solidified product passes into a secondary cooling zone, where sprays of contact water cool the semi-finished product enough to solidify. The product then passes into the cut-off zone where it is cut to the desired length.

Casting machines are either single-strand or multiple-strand. The four main types of continuous casters are based on the shape of the cast product: billet, bloom, round, and slab. Billet casters form squares or rounds between 3 and 7 inches and are multiple-strand casters. Bloom casters form sections ranging between 7 by 7 inches and 14.6 by 23.6 inches and are usually three-strand. Round casters form steel for seamless tube production with diameters between 5 and 9 inches, and are usually multiple-strand. Slab casters form sections up to 12 inches thick and 100 inches wide, and are usually single- or twin-strands. In addition, casters may form beams that are fed directly to I-beam or H-beam rolling mills. Modern slab casters used to manufacture flat-rolled products universally have a curved-mold design, while those used for bar products may have a straight vertical mold design with vertical cutoff or bending with horizontal cutoff. The following table presents continuous casting products and the number of sites casting these products in 1997.

1997 National Estimate For Types of Continuous Casting Products

Type of Cast Product	Number of Sites
Slab	28
Thin slab	8
Round billet	6
Rectangular or square billet	47
Bloom	12
Other ^a	7

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

^aOther types of cast products include beam blanks and near net-shape products.

Continuous casters usually include two separate closed-loop noncontact cooling water systems: one for the copper mold (mold-cooling water system) and one for all other mechanical equipment (machine-cooling water system). Facilities use direct contact water systems for spray cooling and for flume flushing to remove scale from the caster run-out table.

Ingot Casting

Ingot casting involves teeming the molten steel into ingot molds, and then cooling and stripping the ingots out of the molds. The ingots are then heated and rolled into blooms, billets, or slabs during hot forming. Continuous casting, on the other hand, directly forms the molten steel into blooms, billets, or slab, which eliminates the ingot casting steps, increases productivity, and conserves energy. Continuous casting has replaced nearly all ingot casting operations. Ingot casting is used typically for small, specialty batches and for certain applications for producing plate.

5.2.10 Hot Forming

Hot forming is a process in which preheated (typically in the range of 1,800°F), solidified steel is reduced in cross-section through a series of forming steps, in which mechanical pressure is applied through work rolls. These products have numerous cross-sections, lengths, and tonnages. While several different types of hot forming mills are in operation today, the hot forming mills can be grouped into one of the following four types:

- Primary mills;
- Section mills;
- Flat mills (plate, hot strip, and sheet); and
- Pipe and tube mills (seamless and butt-weld).

In general, hot forming primary mills reduce ingots to slabs or blooms, or blooms to billets. Section mills reduce billets to form rod, bar products, structural shapes (e.g., channels, angles), or other forms. Flat mills reduce slabs to plates or strips. Products from section and flat mills may be used to manufacture pipe and tubes. Seamless pipe and tube manufacturing involves piercing round billets, and butt-welded pipe and tube manufacturing begins with strip.

Flat mills, specifically hot strip mills, are the most common type of hot forming mill at integrated steel mills. Hot rolled strip begins with slab, which is heated in one or more furnaces and then undergoes scale breaking in a two-high rolling mill with vertical rolls. The rolls loosen the scale, and high-pressure water jets remove the scale. The slab rolls through four-high roughing stands to a thickness around 1.2 inches. The slab then passes to the finishing train, where a crop-shear cuts both ends and high-pressure steam jets remove scale. Six or seven four-high finishing stands roll the strip to a thickness between 0.06 and 0.4 inches. Both the roughing and finishing stands are usually arranged in tandem.

Forging is another form of steel forming where steel shapes are produced by hammering or by processing in a hydraulic press. Most forging operations are performed on preheated steel. The following table presents the national estimate for types of hot forming operations and the number of sites performing these operations in 1997.

1997 National Estimate for Hot Forming Operations

Hot Forming Operation	Number of Sites
Rolling mill	122
Pipe and tube mill	6
Forging	14

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

The following table presents the national estimate for types of hot forming products and the number of sites producing these products in 1997.

1997 National Estimate for Hot Forming Products

Type of Hot Forming Product	Number of Sites
Bar	67
Beam ^a	8
Billet	25
Bloom ^a	7
Plate	21
Railroad rail ^a	4
Reinforcing bar	25
Rod	17
Sheet	11
Slab ^a	16
Small structural	23
Strip	25
Tube and pipe	21
Other ^b	44

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

^a Estimate is based on detailed survey only. Short surveys did not collect this level of detail.

^b Other hot forming products include various miscellaneous product shapes.

Hand chipping, machine chipping, manual scarfing, grinding, milling, and machine scarfing are methods used to remove surface defects from blooms, billets, and slabs prior to hot rolling. Scarfing removes a thin layer of the steel surface by localized melting and oxidation. The process may be done manually (continuously moving an oxyacetylene torch along the length of the product), or using a scarfing machine located near the entry of the hot forming mill.

Exhaust gases from scarfers contain metal fumes comprising mainly iron oxides and the alloying elements of the steel. These gases are saturated at a temperature of 60°C (140°F) when exiting the scarfer hood. Because the gases are saturated, the following three types of gas cleaning equipment systems are generally used:

1. Wet precipitator - intermittent spray wash;

2. Wet precipitator - continuous wash; and
3. High energy venturi scrubber.

The wet precipitator - intermittent spray wash sprays water on a timed cycle to clean the fume residue that is collected dry on the precipitator plates. The wet precipitator - continuous wash continuously sprays water to remove collected fume residue from precipitator plates. The high energy scrubber requires 45 to 50 inches of water column pressure drop to clean the gases.

Butt-weld pipe or tube is made from hot rolled strip with square or slightly beveled edges called skelp. The width of skelp corresponds to the circumference of the pipe, while the gauge corresponds to the wall thickness. Skelp is preheated to welding temperature in a reheat furnace and drawn through a die or roll forming a cylindrical shape. The edges are pressed together forming a butt-weld. Seamless tubular products are usually made by a piercing process. The process heats, pierces, and shapes a solid round bar or billet to the desired diameter and wall thickness.

Hot forming mills use water for scale breaking, flume flushing, and direct contact cooling. The water often recirculates in cooling water systems. Sites may have multiple hot forming contact water and/or rolling solution systems.

5.2.11 Finishing

Steel finishing operations follow hot forming operations; therefore, integrated steel mills and those stand-alone steel finishing mills that receive steel from integrated steel mills are most likely to perform steel finishing operations. Integrated steel mills in the United States principally produce flat-rolled steel products that require finishing, such as hot rolled strip (hot bands), pickled and oiled strip, cold rolled and annealed strip and sheet, hot coated strip (principally zinc and zinc/aluminum), electroplated strip (principally chromium, tin, zinc), and plates. Several non-integrated steel mills produce flat-rolled products, but most produce bar and bar products and structural and other shapes. Non-integrated steel mills are more likely to ship hot rolled products without further surface treatments or finishing.

The type of steel finishing operation is closely related to the type of steel processed. For carbon steels, acid pickling with hydrochloric acid, cold rolling and annealing, temper rolling, acid and/or alkaline cleaning, hot coating, and electroplating are performed. For stainless steels, descaling (molten salt bath and electrolytic sodium sulfate), sulfuric, nitric, nitric/hydrofluoric acid and sometimes hydrochloric acid pickling, cold rolling and annealing, and temper rolling are likely to be performed. A number of steel finishing mills also perform surface coating of electrical steels.

Acid Pickling and Descaling

Acid pickling and descaling operations clean the steel surface prior to further processing (e.g., cold forming, application of protective and decorative coatings). The steel surface must also be cleaned at various production stages to ensure that oxides that form on the

surface are not worked into the finished product, causing marring, staining, or other surface imperfections.

The acid pickling process chemically removes oxides and scale from the surface of the steel by the action of water solutions of inorganic acids. While acid pickling is only one of several methods of removing undesirable surface oxides, it is most widely used because of comparatively low operating costs and ease of operation. Carbon steel is usually pickled with hydrochloric acid; stainless steels are pickled with sulfuric, hydrochloric, nitric, and hydrofluoric acids. The Agency estimates that 38 of the 75 acid pickling sites use hydrochloric acid, 33 use sulfuric acid, 28 use hydrofluoric acid, and 28 use nitric acid. The pickling process uses various organic chemicals that inhibit the acid from attacking the base metal while permitting it to attack the oxides. Wetting agents improve the effective contact of the acid solution with the metal surface. After the pickling bath, the steel passes through one or more rinse operations.

In addition to the acid pickling operations, finishing mills may regenerate or recover the spent acid by removing the iron. Acids can then be reused by the mill. Hydrochloric acid and sulfuric acid are the more commonly regenerated or recovered acids, although stainless steel finishing mills also recover nitric and mixed nitric/hydrofluoric acids.

Two common types of descaling operations are blast cleaning and salt bath descaling. Blast cleaning (mechanical descaling) uses abrasives such as sand, steel, iron grit, or shot to clean the steel surface. The abrasives come in contact with the steel using either a compressed air blast cleaning apparatus or by a rotary-type blasting cleaning machine. Salt bath descaling, a surface treatment operation, processes stainless or alloy steel products in molten salt solutions. This operation uses the physical and chemical properties of molten salt baths to loosen heavy scale from selected stainless and high-alloy steels; the scale is removed in subsequent water-quenching steps. Two processes, oxidizing and reducing, are commonly referred to by the names of proprietary molten salt descaling baths, Kolene® and Hydride®, respectively. Descaling may also be performed using an electrolytic solution of sodium sulfate.

EPA estimates that, of the 69 sites operating acid pickling and descaling systems, 41 use wet air pollution control and 14 use dry air pollution control.

Cold Forming

Cold forming mills process hot rolled and pickled steels at ambient temperatures to impart desired mechanical and surface properties in the steel. Most cold rolling operations reduce the thickness of the steel much less than hot forming. The following table shows common products formed during cold forming.

1997 National Estimate for Type of Cold Forming Product

Type of Cold Forming Product	Number of Sites
Plate	5
Sheet	21
Strip	47

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

Common cold rolling mills in the iron and steel industry include tandem and temper mills. Tandem mills modify steel sheet properties, including strength, surface properties, and thickness. They are typically used in a series of three to five stands. Temper mills slightly improve the finish of steel sheet, such as shiny, dull, or grooved surfaces, and generally do not modify shape or thickness. They primarily improve flatness, alter mechanical properties, and minimize surface disturbances. Temper mills are typically used with only one or two stands.

Sendzimir cold rolling mills, commonly referred to as Z-mills, are another type of cold rolling operation. They have various configurations; typically, however, steel passes through work rolls that are supported and driven by first- and second-intermediate rolls. The mill design allows for quick adjustments to vary the width, thickness, and hardness of the rolled steel. These mills typically use hydraulic fluid or oil emulsions rather than aqueous rolling solutions.

Cold forming operations generate heat that is dissipated by flooded lubrication systems. These systems use palm oil or synthetic oils that are emulsified in water and directed in jets against the rolls and the steel surface during rolling.

Surface Treatment and Annealing Operations

Surface treatment and annealing operations include a wide range of operations, including alkaline cleaning, annealing, hot coating, and electroplating. Facilities performing finishing operations often have a number of these operations on a single line.

Alkaline cleaners remove mineral and animal fats and oils from the steel surface. Caustic, soda ash, alkaline silicates, and phosphates are common alkaline cleaning agents. Passing the steel through alkaline solutions of specified compositions, concentrations, and temperatures is often enough to clean the product; however, for large-scale production or a cleaner product, sites may use electrolytic cleaning. Sometimes adding wetting agents to the cleaning bath facilitates cleaning.

The annealing process heats steel to modify its bulk properties, which makes the steel easier to form and bend. Steel is heated and kept at a designated temperature and then

cooled at a designated rate. Through the annealing process, the metal grain size increases, new bonds are formed at the higher temperature, and the steel becomes more ductile. Sites perform annealing through a batch or continuous process; they may follow annealing operations with a water quench to cool the steel for further processing.

Steel coating operations, such as hot coating and electroplating, improve resistance to corrosion or improve appearance. Hot coating operations involve immersing precleaned steel into molten baths of tin, zinc (hot galvanizing), combinations of lead and tin (terne coating), or combinations of aluminum and zinc (galvalume coating), any associated cleaning or fluxing (used to facilitate metal application) steps prior to immersion, and any post-immersion steps (e.g., chromium passivation). Based on survey responses, the metals used for hot coating operations include zinc, zinc/aluminum alloy, aluminum, chromium, lead, antimony, tin/lead alloy, and zinc/nickel alloy.

Electroplated steel production uses electrodes to deposit a metal coating onto the steel. Historically, electroplating at steel mills was limited to tin and chromium electroplating for food and beverage markets and relatively low-tonnage production of zinc electroplated (electrogalvanized) steel for the automotive market. In recent years, electrogalvanized steel production has increased substantially in response to automobile manufacturers' demand. New coatings consisting of combinations of iron, nickel, and other metals have been developed. Based on survey responses, the metals used for electroplating operations include zinc, chromium, tin, nickel, brass, cobalt, copper, nickel/tin alloy, zinc/nickel alloy, and zinc/iron/aluminum alloy.

EPA estimates that, of the 98 sites performing surface treatment operations, 38 operate wet air pollution control systems and 16 operate dry systems.

5.3 References

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- 5-3 Association of Iron and Steel Engineers. The Making, Shaping and Treating of Steel (10th edition). ISBN 0-930767-00-4, Pittsburgh, PA, 1985.
- 5-4 Georgetown Steel Corporation. "Beginning with Iron Ore: The DRI Process," Georgetown Steel Corporation brochure, Georgetown, SC.
- 5-5 The Forging Industry Association. The Forging Industry Association's How Are Forgings Produced?. <http://www.forging.org/facts/why6.htm>, 2000.

- 5-6 American Iron and Steel Institute. AISI's Everything You Always Wanted to Know About Steel. . . A Glossary of Terms and Concepts. Courtesy of Michelle Applebaum, Managing Director (Summer 1998). Salomon Smith Barney Inc, <http://www.steel.org/learning/glossary/>, 2000.
- 5-7 Association of Iron and Steel Engineers. The Making, Shaping and Treating of Steel (11th edition), Ironmaking Volume. Pittsburgh, PA, 1999.
- 5-8 Encyclopaedia Britannica. Britannica.com. <http://www.britannica.com>, Chicago, IL.

Table 5-1**1997 National Estimate of Types of Iron and Steel Sites in the United States**

Type of Site	Total Number of Sites Operating in 1997 (% of Industry Total)
Integrated steel mill with coke plant	9 (3.5%)
Integrated steel mill without coke plant	11 (4.5%)
Stand-alone coke plant ^a	15 (6.0%)
Stand-alone sintering plant ^b	2 (<1%)
Stand-alone direct reduced ironmaking plant ^c	1 (<1%)
Non-integrated steel mill	94 (37%)
Stand-alone hot forming mill	39 (15.5%)
Stand-alone finishing mill	70 (28%)
Stand-alone pipe and tube mill	11 (4.5%)
TOTAL^d	254

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

^aOne of the stand-alone coke plants is a non-recovery coke plant. One additional non-recovery coke plant started operations after 1997 and is not reflected in this table.

^bOne stand-alone sinter plant has been shut down indefinitely since 1997.

^cA stand-alone direct reduced ironmaking plant started operations after 1997.

^dColumns do not sum to totals because of rounding each number and because two sites are counted as one integrated steel mill.

Table 5-2**Survey Response of Sites Producing Steel Types**

Type of Site ^a	Total Number of Sites Responding to Survey	Number of Survey-Responding Sites Producing Each Type of Steel		
		Carbon Steel	Stainless Steel	Alloy Steel
Integrated steel mill with coke plant	9	9	1	6
Integrated steel mill without coke plant	11	11	2	5
Non-integrated steel mill	66	56	16	43
Stand-alone hot forming mill	17	14	7	13
Stand-alone finishing mill	38	28	13	12
TOTAL	141	118	39	79

Source: U.S. EPA, [U.S. EPA Collection of 1997 Iron and Steel Industry Data](#) (Detailed and Short Surveys).

^aTotals for stand-alone pipe and tube mills not disclosed to prevent compromising confidential business information.

Table 5-3

**1997 National Estimate of Number of Direct, Indirect,
and Zero Discharging Sites**

Type of Site	Total Number of Sites^a	Number (%) of Direct Dischargers	Number (%) of Indirect Dischargers	Number (%) of Zero or Alternative Dischargers^b
Integrated steel mill with coke plant	9	8 (89%)	3 (33%)	0 ^c
Integrated steel mill without coke plant	11	11 (100%)	0 ^c	0 ^c
Stand-alone coke plant	15	9 (60%)	5 (33%)	1 (7%)
Stand-alone sintering plant	2	1 (50%)	0 ^c	1 (50%)
Stand-alone direct reduced ironmaking plant	1	0 ^c	1 (100%)	0 ^c
Non-integrated steel mill	94	46 (49%)	19 (20%)	32 (34%)
Stand-alone hot forming mill	39	22 (56%)	6 (15%)	12 (31%)
Stand-alone finishing mill	70	28 (40%)	34 (49%)	11 (16%)
Stand-alone pipe and tube mill	11	8 (72%)	3 (27%)	0 ^c
TOTAL ^d	254	133 (53%)	70 (28%)	56 (22%)

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

^aThe sum of direct dischargers, indirect dischargers, and zero dischargers may not equal the total number of sites. Sites may directly and indirectly discharge wastewater from their site.

^bZero dischargers include sites that do not discharge process wastewater as well as sites that are completely dry.

^cCells with a zero (0) value indicate that none of the survey respondents have the characteristic. However, it is possible for nonsurveyed facilities to have the characteristic corresponding to that cell.

^dColumns do not sum to totals because of rounding each number and because two sites are counted as one integrated mill.

Table 5-4

**1997 National Estimate of Actual Production and
Rated Capacity by Manufacturing Operation**

Manufacturing Operation	Total Number of Sites with this Operation	Total 1997 Production (million standard tons)	Total 1997 Rated Capacity (million standard tons)
Cokemaking	24	20.4	22.6
Sintering	9	12.4	17.9
Blast furnace ironmaking	20	54.5	68.6
BOF steelmaking	20	65.9	78.3
EAFF steelmaking	96	50.8	75.8
Vacuum degassing	44	18.0	39.1
Ladle metallurgy	103	102	158
Casting	113	110	142
Hot forming	153	127	177 ^a
Acid pickling and descaling	69	48.3	67.9 ^a
Cold forming	103	72.8	105
Surface cleaning and coating	98	35.3	40.1
Briquetting or other agglomeration process	4	nd	nd
Direct reduced ironmaking	2	nd	nd

Source: U.S. EPA, U.S. EPA Collection of 1997 Iron and Steel Industry Data (Detailed and Short Surveys).

^aThis estimate is from the detailed survey only.

nd - Not disclosed to prevent compromising confidential business information.

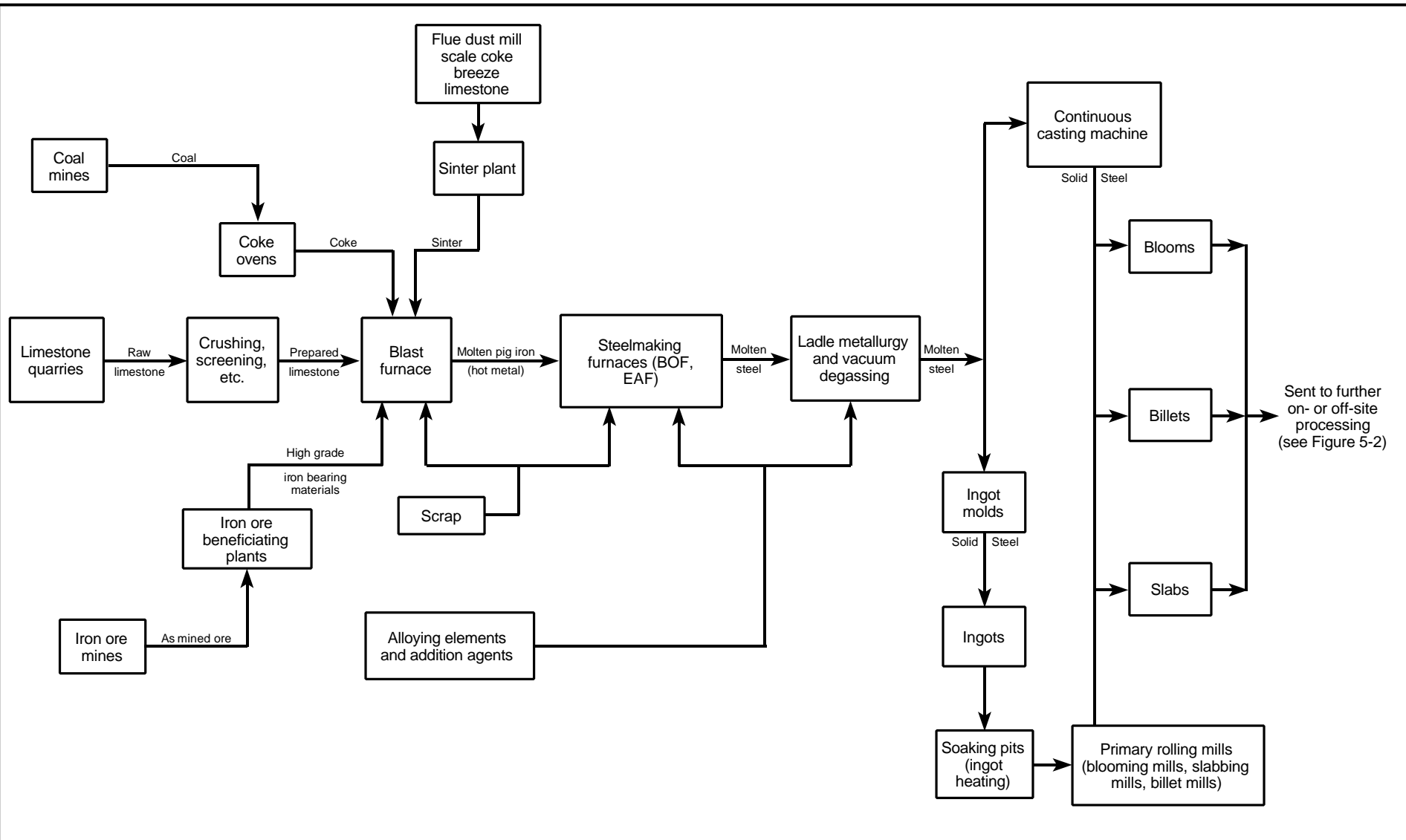
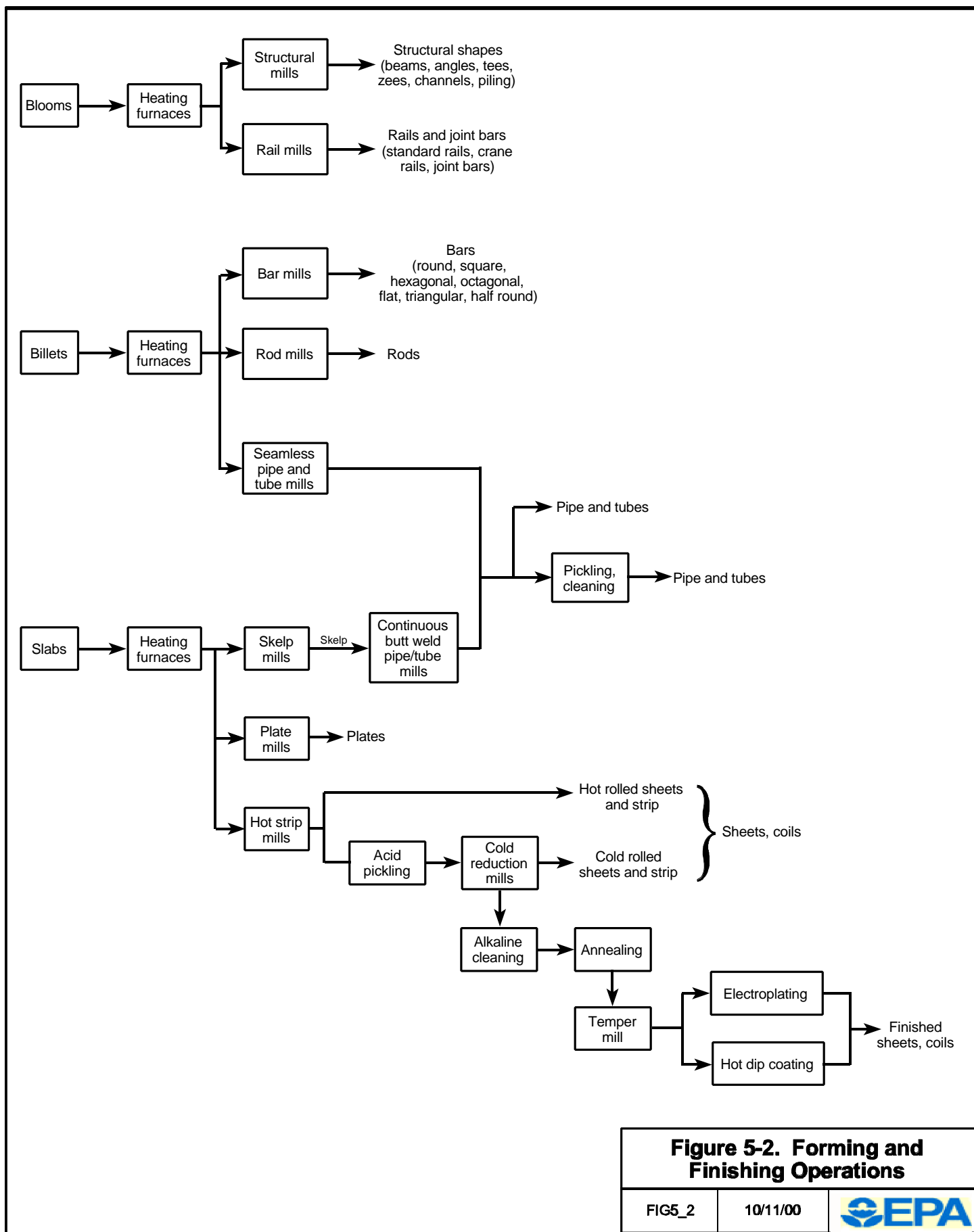


Figure 5-1. Iron and Steelmaking Operations

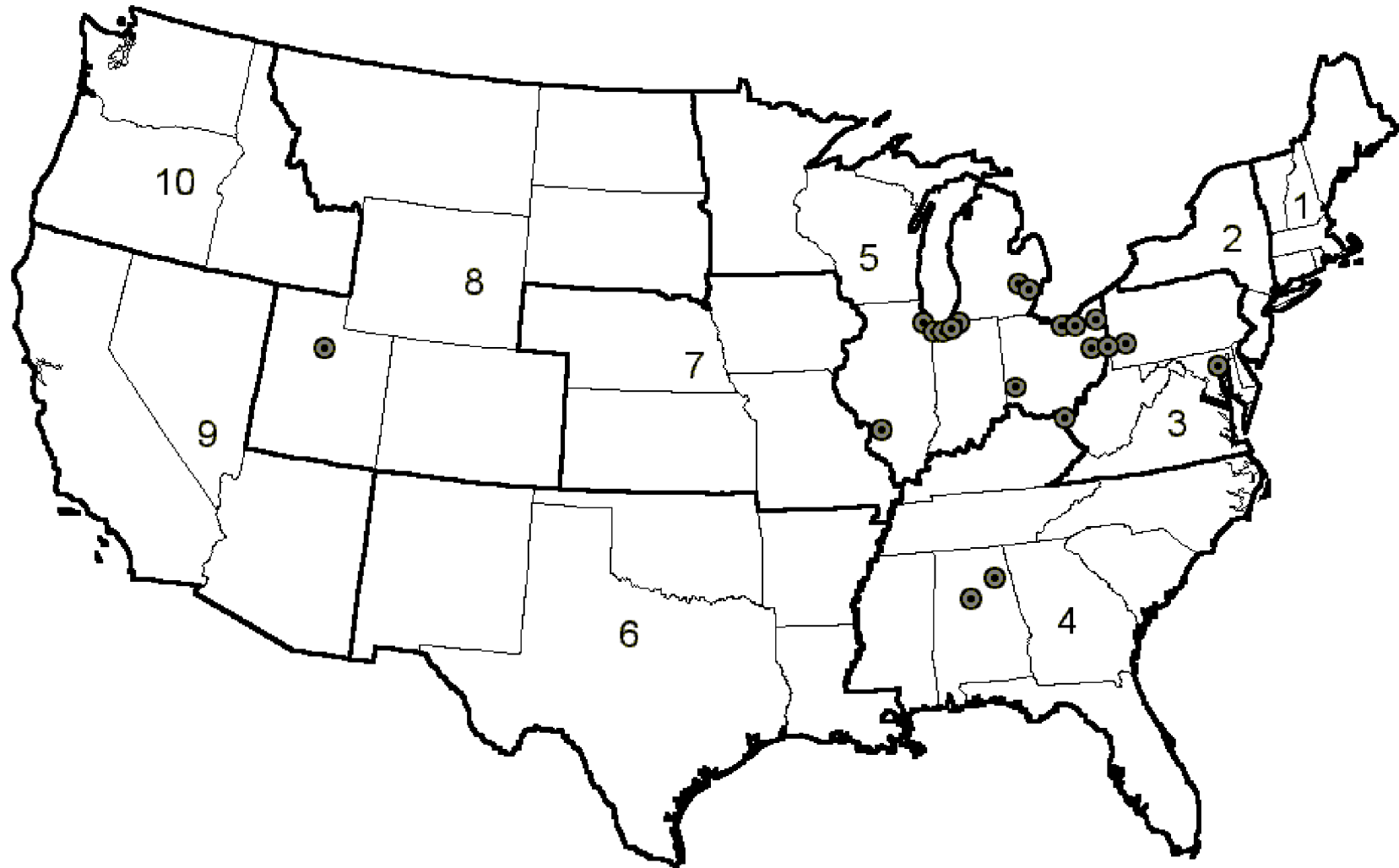
FIG5_1

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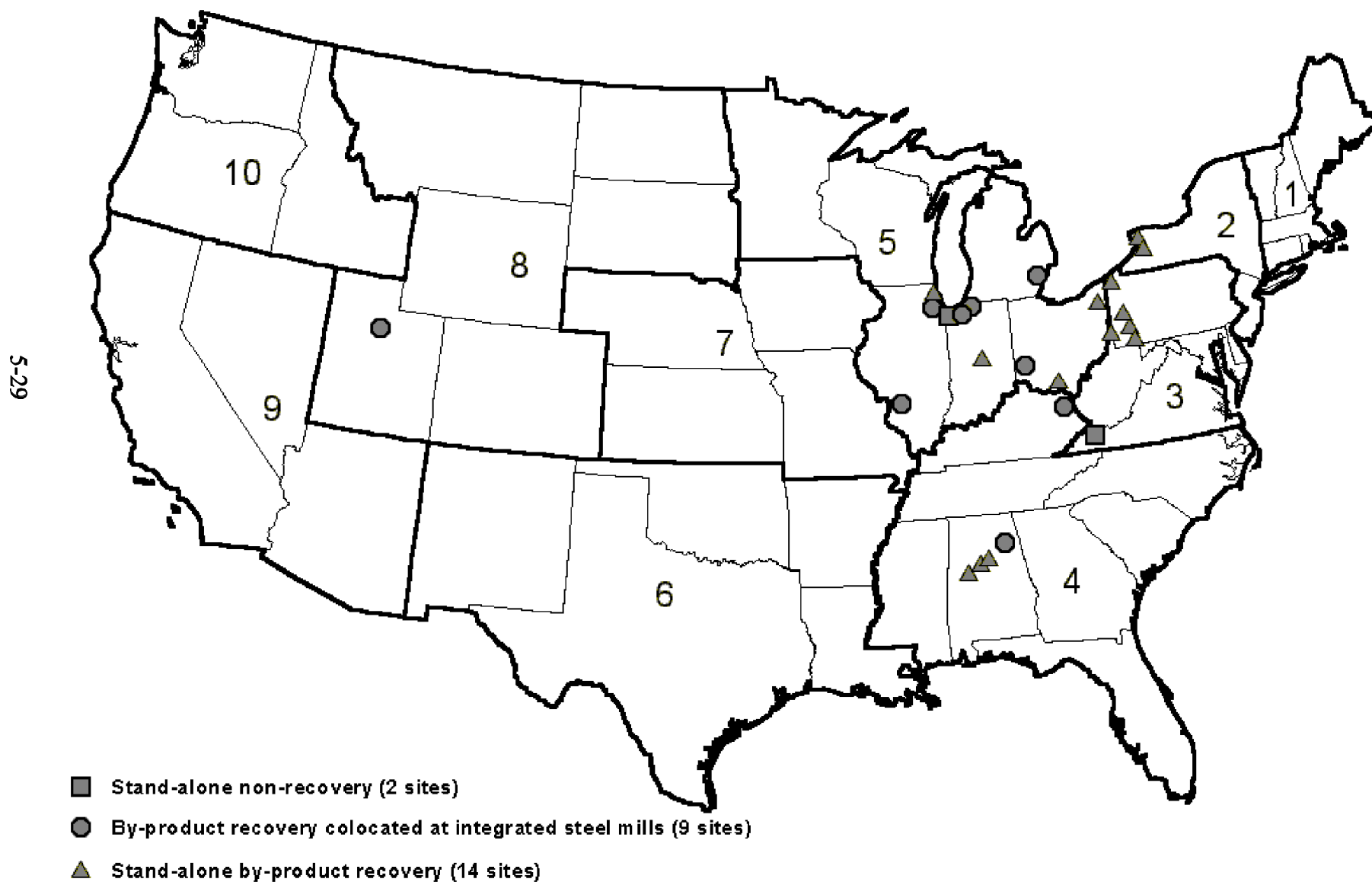


**Figure 5-3.
Integrated Steel Manufacturing Sites**



Smaller stand-alone forming and finishing facilities are generally located near steel manufacturing sites.

**Figure 5-4.
Cokemaking Sites**



SECTION 6

SUBCATEGORIZATION

This section presents the proposed subcategorization for the Iron and Steel effluent limitations guidelines and standards. Section 6.1 presents EPA's subcategorization criteria and the proposed subcategories and discusses differences between the 1982 subcategorization and the proposed subcategorization. Sections 6.2 through 6.8 present each proposed subcategory in detail and review the segments and manufacturing operations within each subcategory.

6.1 Subcategorization Process

To develop the regulation, the Agency had to determine whether different effluent limitations and standards were appropriate for distinct subcategories within the industry. The Clean Water Act (Section 304(b)(2)(b), 33 U.S.C. § 1314 (b)(2)(B)) requires the Agency to consider certain factors for subcategorization, as well as process and engineering factors. These factors include:

- Age of equipment and facilities;
- Location;
- Size of site;
- Manufacturing processes employed;
- Wastewater characteristics;
- Economic impacts; and
- Non-water quality impacts.

In considering these factors, EPA analyzed industry survey data and EPA sampling data for trends in discharge flow rates, pollutant concentrations, and treatability to determine where subcategorization was warranted. Based on this analysis, the Agency has adopted a revised subcategorization of the industry for the proposed rule. The revised subcategorization not only reflects the production and wastewater treatment changes in the industry since the last rulemaking, but also simplifies the regulation and incorporates the experience that the Agency and other regulatory entities have gained from implementing the 1982 Iron and Steel effluent limitations guidelines and standards.

Of all the subcategorization criteria, EPA identified manufacturing processes as the most significant factor for subcategorization, and divided the industry into seven primary process subcategories on this basis. In addition, EPA used manufacturing operations, type of product, and wastewater characteristics, including flow rates with respect to production and type of pollutant present, to segment within certain subcategories. The Agency decided to further divide segments in some cases, based on different wastewater pollutant characteristics, wastewater flow rates, and/or process operations. Section 7 discusses in detail wastewater sources, production-normalized flow rates, and pollutants for each segment. Tables 6-1 and 6-2 present the 1982 and

proposed subcategorization, respectively. Table 6-3 compares the subcategorization for the 1982 and the proposed regulations.

Manufacturing process changes in the iron and steel industry have resulted in changes to the current subcategorization and the proposal of the new subcategorization. EPA removed three segments from the proposed subcategorization because the manufacturing operations are no longer practiced in the United States: the Beehive Cokemaking Segment of the Cokemaking Subcategory, the Ferromanganese Blast Furnace Segment of the Ironmaking Subcategory, and the Open Hearth Furnace Segment of the Integrated Steelmaking Subcategory. In addition, the Agency added one segment and one subcategory to include iron and steel manufacturing processes that are not covered under the 1982 regulation: the proposed Cokemaking Subcategory includes a segment for non-recovery cokemaking operations, and the Other Operations Subcategory has been created to regulate direct reduced ironmaking, briquetting, and forging.

Changes to the proposed subcategorization are also a result of applicability changes for iron and steel and other effluent limitations guidelines and standards. In contrast to the 1982 regulation, the proposed regulation covers cold forming only as it pertains to cold rolling of flat products. The Agency has determined that operations associated with cold forming of pipe and tube and cold drawing or extrusion operations are more appropriately regulated by the proposed Metal Products and Machinery regulation, because the products produced and wastewater characteristics generated by these operations more closely resemble those seen in the metal products and machinery industry. For similar reasons, electroplating of flat products at iron and steel facilities, currently regulated by the concentration-based Metal Finishing regulation (40 CFR Part 433), is more appropriately regulated by the iron and steel effluent limitations guidelines and standards. EPA has consequently added electroplating to the Steel Finishing Subcategory to simplify coverage of this manufacturing operation at iron and steel facilities.

Wastewater characteristics also had an impact on modifications to the subcategorization. The Agency determined that subcategorization and segmentation based on wastewater characteristics is warranted because wastewaters from the various processes contain different pollutants that generally require different wastewater control systems. However, EPA also designed the proposed regulation to facilitate co-treatment of compatible wastewaters, by including manufacturing operations that generate wastewaters amenable to co-treatment in the same subcategory. Sections 6.2 through 6.8 discuss these changes. Sections 7 and 10 discuss wastewater characteristics and pollutant loadings, respectively.

Another appropriate revision to the 1982 subcategorization is segmentation based on the type of steel processed. In the 1982 regulation, segments exist for carbon steel and specialty steel (stainless and alloy steels). For the proposed regulation, the Agency determined that, for three subcategories, it is appropriate to have separate segments for carbon and alloy steels and for stainless steels. EPA determined that this change better reflects pollutants found within each segment. For example, chromium and nickel are currently regulated in the stainless steel segment but not in the carbon and alloy steel segment.

EPA evaluated other factors and determined them to be insignificant to subcategorization. The Agency evaluated the age of facilities relative to production-normalized wastewater discharge rates (volume of water discharged with respect to production). The comparison between the age of the facilities and the respective process wastewater discharge rates showed no relationships between mill age and the volume of process wastewater discharged. Therefore, the Agency determined that the age of facilities and equipment did not have an impact on wastewater generation or discharge. The results of EPA's analysis of facility age versus wastewater discharge rate are located in the Iron and Steel Administrative Record for the proposed rule.

The Agency also evaluated facility age with respect to installing or upgrading wastewater treatment equipment and found that, while a site or a plant may have been operating for several decades, manufacturing and treatment systems are regularly upgraded. In certain cases, older sites actually have modern wastewater treatment systems and have demonstrated model BAT treatment. Consequently, the Agency has determined that subcategorization based on facility age was not warranted. In addition, since system upgrades frequently occur within the industry, the Agency included sufficient costs in its evaluation of technology options to account for treatment system modifications at all iron and steel facilities regardless of their age.

The Agency also evaluated location of sites with respect to the amount of process wastewater discharged. While the Agency realizes that facilities located in arid and semi-arid regions of the country may have lower discharge flow rates due to water loss from evaporation, EPA developed the flow allowances in the proposed regulation to be achievable in any region of the country. Therefore, the Agency determined that location was not a significant criteria for subcategorization. The results of EPA's analysis of location versus wastewater discharge rate are located in the Iron and Steel Administrative Record for the proposed rule.

While larger iron and steel sites discharge greater total volumes of wastewater, the size of a site (e.g., acreage, number of employees) did not have an impact on production-normalized wastewater discharge rates or pollutant concentrations. Consequently, the Agency determined that size was also not a significant factor for subcategorization. Similarly, EPA evaluated non-water quality impacts, such as solid waste and air emission effects, and determined that these did not constitute a basis for subcategorization in the proposed rule. However, EPA did evaluate non-water quality impacts during EPA's rulemaking process, as discussed in detail in Section 13. With the exception of the Integrated and Stand-Alone Hot Forming Subcategory, economic impacts were determined not to have an impact on subcategorization. Section 9 presents a detailed discussion of economic impacts.

Since the elements to these factors have not changed since the 1982 rule, refer to Volume I of the Technical Development Document for the 1982 regulation (pages 155 to 163, EPA 440/1-82/024, May 1982) for a more detailed review of the above factors.

6.2 Subcategory A: Cokemaking

Cokemaking operations include foundry and blast furnace coke production at integrated and stand-alone facilities. The Cokemaking Subcategory has been segmented into by-product recovery and non-recovery cokemaking operations. The Non-recovery Cokemaking Segment includes non-recovery cokemaking processes that have either existed for many years or are currently emerging in the industry. Other than low-volume boiler blowdown and process area storm water, non-recovery cokemaking processes do not generate wastewater like the by-product recovery processes do. This major difference in wastewater flow necessitated the segmentation of this subcategory. Two stand-alone facilities in the United States practice non-recovery cokemaking.

By-product recovery coke plants comprise 23 of the 25 cokemaking facilities in the United States. All 9 integrated facilities with coke plants and 14 of the 16 stand-alone cokemaking facilities operate by-product ovens. By-product recovery cokemaking generates process wastewater from the release of moisture and volatile compounds from coal and from the by-product recovery operations.

To reflect slightly different wastewater generation rates, the 1982 regulation further segments by-product recovery cokemaking operations by those coke plants that manufacture coke for blast furnaces and merchant coke plants. Merchant coke plants provide more than 50 percent of the coke produced to operations, industries, or processes other than ironmaking blast furnaces associated with steel production. In 1982, EPA determined that the model flow rates for blast furnace and merchant coke plants, including control water, were 153 gallons per ton (gpt) and 170 gpt, respectively. Since EPA did not observe these differences in wastewater generation rates when analyzing the 1997 industry survey data, the Agency eliminated this segment.

6.3 Subcategory B: Ironmaking

Ironmaking operations include sintering and blast furnace ironmaking at integrated steel plants and stand-alone facilities. The 1982 regulation distinguishes sintering and blast furnace operations as two subcategories; EPA combined these operations into one subcategory in the proposed regulation because of similar wastewater pollutant characteristics and the potential for co-treatment of sintering and blast furnace wastewaters. However, the Agency divided the subcategory into two segments, sintering and blast furnace ironmaking, based on differences in flow rates and manufacturing processes. The Agency decided to further divide the sintering segment due to differences in wastewater generation, as discussed below.

Facilities use two types of air pollution control systems to treat air emissions from sinter plants: wet and dry. Sinter plants that operate dry air pollution controls do not generate process wastewater. In 1997, the period for which industry survey data were collected, eight sinter plants were in operation (a ninth plant providing data had been inactive since 1995), six at integrated facilities and two stand-alone facilities. Of the eight plants, six operated wet air pollution control systems and two operated dry air pollution control systems. Since the industry

survey data were collected, one plant operating a wet air pollution control system has converted to a dry system and another plant operating a wet air pollution control system has been deactivated indefinitely. The four remaining sinter plants with wet air pollution control systems are located at integrated steel plants; three of these sites co-treat sinter plant wastewater with blast furnace wastewater, and the fourth site co-treats sinter plant wastewaters with wastewaters from several other operations. Twenty integrated steel plants operated 40 blast furnaces in 1997. Every blast furnace in the United States operates a wet gas cleaning system to cool and clean the furnace off-gases prior to reuse.

6.4 Subcategory C: Integrated Steelmaking

Integrated steelmaking operations include basic oxygen furnace (BOF) steelmaking, ladle metallurgy, vacuum degassing, and continuous casting manufacturing processes at integrated steel plants. EPA combined these operations into one subcategory because of similar wastewater pollutant characteristics and the potential for co-treatment of compatible wastewaters. EPA decided to further subcategorize the subcategory to the manufacturing process level, because of differences in wastewater generation rates. These manufacturing processes are discussed below.

Facilities use three types of air pollution control systems to treat furnace off-gases from BOF steelmaking operations: semi-wet, wet-open combustion, and wet-suppressed combustion. Each type of air pollution control system operates differently and generates different wastewater flow rates. However, the wastewater characteristics are similar. Twenty integrated steel plants and one non-integrated steel plant operate a total of 24 BOF shops. Of the 24 BOF shops, eight use semi-wet air pollution control systems, eight use wet-open combustion air pollution control systems, seven use wet-suppressed combustion air pollution control systems, and one uses a combination wet-open/wet-suppressed combustion air pollution control system.

Twenty integrated steel mills operate a total of 30 continuous casters. Twenty-five of these continuous casters cast slabs for the production of flat-rolled products (e.g., strip and plate); the remaining five continuous casters cast blooms and billets. The Agency determined that the type of product cast did not have a significant impact on wastewater generation and that no further division of continuous casting is necessary.

The 1982 regulation distinguishes steelmaking, vacuum degassing, and continuous casting operations as three separate subcategories. The new subcategorization consolidates these operations into the Integrated Steelmaking Subcategory due to similarities in their wastewater. EPA proposes to regulate electric arc furnace (EAF) steelmaking (which was part of the 1982 Steelmaking Subcategory) under the Non-Integrated Steelmaking and Hot Forming Subcategory, as well as vacuum degassing, ladle metallurgy, and continuous casting operations at non-integrated plants. The Agency proposes segregating steelmaking operations at integrated plants and non-integrated plants to simplify the structure of the regulation and because different wastewater generation rates were observed between integrated and non-integrated plants.

6.5 Subcategory D: Integrated and Stand-Alone Hot Forming

Integrated and stand-alone hot forming operations include all hot forming processes at integrated steel plants and stand-alone hot forming mills. Four different types of hot forming mills are operated at integrated and stand-alone facilities: flat mills (hot strip and sheet mills and plate mills), primary mills (slabbing and blooming mills), section mills (bar and rod mills), and hot formed pipe and tube mills. The 1982 regulation segregates the Hot Forming Subcategory into four different segments based on differences in flow rates:

1. Primary mills
 - Carbon and specialty primary mills with scarfing,
 - Carbon and specialty primary mills without scarfing;
2. Section mills
 - Carbon section mills,
 - Specialty section mills;
3. Flat mills
 - Carbon and specialty hot strip and sheet mills,
 - Carbon plate mills,
 - Specialty plate mills; and
4. Pipe and tube mills.

In the proposed regulation, EPA proposes two segments, Carbon and Alloy Steel and Stainless Steel, for the Integrated and Stand-Alone Hot Forming Subcategory because of differences in pollutants present in the wastewater. EPA did not propose to segment this subcategory based on mill type because the Agency has determined that all hot forming mills can achieve the same wastewater discharge rate with the proper use of wastewater recycle. The 1982 Hot Forming Subcategory also regulates hot forming processes at non-integrated plants; however, EPA proposes to regulate non-integrated hot forming processes under the Non-Integrated Steelmaking and Hot Forming Subcategory to simplify the structure of the regulation.

6.6 Subcategory E: Non-Integrated Steelmaking and Hot Forming

Non-integrated steelmaking and hot forming operations include EAF steelmaking, ladle metallurgy, vacuum degassing, continuous casting, and hot forming operations performed at non-integrated mills. EPA has combined these operations into one subcategory because of similar wastewater pollutant characteristics and the potential for co-treatment of these wastewaters. EPA proposes two segments, Carbon and Alloy Steel and Stainless Steel, in this subcategory due to differences in wastewater pollutant characteristics. EPA decided to further divide these segments based on differences in manufacturing operations.

Departing from the structure of the 1982 regulation, EPA proposes the Non-Integrated Steelmaking and Hot Forming Subcategory to simplify the regulatory structure by

grouping the basic steelmaking and hot forming operations performed at non-integrated plants under one subcategory. In addition, the Agency proposes to separate the non-integrated and integrated steelmaking and hot forming operations because of major differences in the flow rates. Non-integrated facilities demonstrate substantially lower wastewater flow rates due to their lower water application rates, use of high-rate water recycle systems, and good water management practices.

6.7 Subcategory F: Steel Finishing

Since extensive co-treatment of steel finishing wastewaters is currently practiced by the industry, the Agency proposes a simplified regulatory structure for steel finishing operations because of the compatibility of wastewaters for treatment. In addition, EPA proposes that the proposed regulation no longer apply to several types of products (e.g., bars, billets, rods, and wire) that are currently regulated by the 1982 regulation. The Agency has determined that finishing operations for these products are more appropriately regulated by the proposed Metal Products and Machinery rule (see Section 1).

Steel finishing operations include salt bath and electrolytic sodium sulfate (ESS) descaling, acid pickling, cold forming, alkaline cleaning, continuous annealing, hot coating, and electroplating at integrated, non-integrated, and stand-alone facilities. EPA divided this subcategory into Carbon and Alloy Steel and Stainless Steel Segments due to variations in wastewater pollutant characteristics and flow rates.

Carbon and Alloy Steel Finishing

After reviewing the industry survey data, the Agency identified nine discrete manufacturing operations for the Carbon and Alloy Steel Segment of the Steel Finishing Subcategory:

1. Hydrochloric acid pickling;
2. Sulfuric acid pickling;
3. Acid regeneration;
4. Cold forming;
5. Alkaline cleaning;
6. Continuous annealing;
7. Hot coating;
8. Electroplating; and
9. Wet air pollution control devices.

EPA decided to further subcategorize to the manufacturing process operation level for this subcategory because of differences in wastewater flow rates. These operations are described below.

EPA has defined acid pickling lines as including annealing and other surface cleaning and surface preparation operations located on the same line. The Agency grouped three

acid pickling manufacturing operations in this segment: hydrochloric acid pickling, sulfuric acid pickling, and acid regeneration. Different acid types generate different wastewater flow rates. The following table shows the acid pickling manufacturing operations and the associated product types in the Carbon and Alloy Steel Segment.

Carbon and Alloy Steel Acid Pickling Operations and Product Types

Acid Pickling Operation	Product Type
Hydrochloric Acid Pickling	<ul style="list-style-type: none"> • Strip, sheet • Bar, billet, rod, coil • Pipe, tube • Plate
Sulfuric Acid Pickling	<ul style="list-style-type: none"> • Strip, sheet • Bar, billet, rod, coil • Pipe, tube • Plate
Acid Regeneration	<ul style="list-style-type: none"> • Fume Scrubbers

Cold forming operations in the proposed rule apply to only cold rolling of flat products. Other cold forming operations are to be regulated by the proposed Metal Products and Machinery effluent guidelines limitations and standards. Cold forming operations in this segment include single and multiple rolling stands on a given mill. Furthermore, three methods of rolling solution application are included: direct, recirculation, or combinations of direct and recirculation.

Alkaline cleaning operations in this segment include stand-alone alkaline cleaning lines and continuous annealing/alkaline cleaning lines (i.e., alkaline cleaning lines with continuous annealing located on the same continuous line). The two product types for carbon and alloy steel alkaline cleaning are: 1) strip and sheet; and 2) pipe and tube. Although the wastewater characteristics are similar, different product types generate different wastewater flow rates.

Stand-alone continuous annealing operations in this segment include lines with and without a water quench. Quench water is the only source of wastewater from these lines.

Hot coating operations in this segment include continuous process lines having surface cleaning and surface preparation operations located on the same line. The proposed regulation covers hot coating of flat steel product only (i.e., strip, sheet, and plate).

Electroplating operations in this segment include continuous process lines having surface cleaning and surface preparation operations located on the same line. Electroplating operations include tin/chrome electroplating of strip and sheet, other metal electroplating of strip and sheet, and electroplating of plate. Different operations generate different wastewater flow rates.

Although electroplating at iron and steel facilities is currently regulated by 40 CFR Part 433, Metal Finishing, the Agency has determined that it is appropriate to regulate electroplating of flat products in the proposed regulation because a large number of iron and steel facilities perform these operations. With pretreatment where appropriate, electroplating wastewaters are compatible with wastewaters from other steel finishing operations. Additionally, by covering electroplating in the iron and steel regulation, all operations at iron and steel mills will have production-based limitations. Currently, the electroplating limitations in the Metal Finishing effluent limitation guidelines and standards are concentration-based, requiring permit writers to combine production- and concentration-based limitations when permitting iron and steel facilities with electroplating operations. Therefore, the proposed regulation simplifies the current permitting process for flat product electroplating.

Stainless Steel Finishing

After reviewing the survey data, the Agency identified six discrete manufacturing operations for the Stainless Steel Finishing Segment of the Steel Finishing Subcategory:

1. Acid pickling and other descaling;
2. Acid regeneration;
3. Cold forming;
4. Alkaline cleaning;
5. Continuous annealing; and
6. Wet air pollution control devices.

Differences in wastewater flow rates and process operations were the basis for the divisions in the Stainless Steel Finishing Segment. Certain manufacturing operations have been further divided on the basis of product type to account for wastewater flow rate differences within a given operation. Although the wastewater characteristics are similar among the operations, different operations generate different wastewater flow rates.

After reviewing the industry survey data, the Agency did not identify any stand-alone salt bath or ESS descaling lines. The information in the industry survey responses indicated that salt bath and ESS descaling operations currently take place on stainless steel acid pickling lines. Therefore, salt bath and ESS descaling will be accounted for in stainless steel acid pickling operations. EPA has defined acid pickling operations as including annealing and other surface cleaning and surface preparation operations located on the acid pickling line. The Agency grouped two operations for stainless steel acid pickling: acid pickling and other descaling operations and acid regeneration. The following table shows acid pickling manufacturing operations and their associated product types in the Stainless Steel Segment.

Stainless Steel Acid Pickling Operations and Product Types

Acid Pickling Operation	Product Types
Acid Pickling and Other Descaling	<ul style="list-style-type: none"> • Strip, sheet • Bar, billet, rod, coil • Pipe, tube • Plate
Acid Regeneration	<ul style="list-style-type: none"> • Fume Scrubbers

Cold forming operations in the proposed rule apply to only cold rolling of flat products. Other cold forming operations are to be regulated by the proposed Metal Products and Machinery effluent guidelines limitations and standards. Cold forming operations in this segment include single and multiple rolling stands on a given mill. Furthermore, three methods of rolling solution application are included: direct, recirculation, or combinations of direct and recirculation.

Alkaline cleaning operations in this segment include stand-alone alkaline cleaning lines and continuous annealing/alkaline cleaning lines (i.e., alkaline cleaning lines with continuous annealing located on the same continuous line). Operations with different product types generate different wastewater flow rates. The two product types for stainless steel alkaline cleaning are: 1) strip and sheet; and 2) pipe and tube.

Stand-alone continuous annealing operations in this segment include lines with and without a water quench. Quench water is the only source of wastewater from these lines.

6.8 Subcategory G: Other Operations

The Other Operations Subcategory includes the following three segments: direct reduced ironmaking, forging, and briquetting operations. The Agency determined that it is necessary to segment this subcategory on the basis of manufacturing process differences and wastewater flow rate differences. These manufacturing operations are not covered by the 1982 regulation; however, because these manufacturing operations are directly related to iron and steel production and are performed at iron and steel sites, the Agency determined that it is appropriate to regulate them under the proposed regulation.

Table 6-1

1982 Subcategorization

Subcategory		Segment	Manufacturing Process
A	Cokemaking	By-Product	Iron and Steel
			Merchant
		Beehive	---
B	Sintering	---	---
C	Ironmaking	Iron Blast Furnace	---
		Ferromanganese Blast Furnace	---
D	Steelmaking	Basic Oxygen Furnace	Semi-Wet
			Wet-Suppressed Combustion
			Wet-Open Combustion
		Open Hearth Furnace	Wet
		Electric Arc Furnace	Semi-Wet
			Wet
E	Vacuum Degassing	---	---
F	Continuous Casting	---	---
G	Hot Forming	Primary	Carbon and Specialty Mills without Scarfers
			Carbon and Specialty Mills with Scarfers
		Section	Carbon Mills
			Specialty Mills
		Flat	Hot Strip and Sheet Mills
			Carbon Plate Mills
			Specialty Plate Mills
		Pipe and Tube Mills	---

Table 6-1 (Continued)

Subcategory		Segment	Manufacturing Process
H	Salt Bath Descaling	Oxidizing	Sheet, Plate - Batch
			Rod, Wire, Bar - Batch
			Pipe, Tube - Batch
			Continuous
		Reducing	Batch
			Continuous
I	Acid Pickling	Sulfuric Acid	Rod, Wire, Coil
			Bar, Billet, Bloom
			Strip, Sheet, Plate
			Pipe, Tube, Other
			Fume Scrubber
		Hydrochloric Acid	Rod, Wire, Coil
			Strip, Sheet, Plate
			Pipe, Tube, Other
			Fume Scrubber
			Acid Regeneration
		Combination Acid	Rod, Wire, Coil
			Bar, Billet, Bloom
			Strip, Sheet, Plate - Continuous
			Strip, Sheet, Plate - Batch
			Pipe, Tube, Other
			Fume Scrubber

Table 6-1 (Continued)

Subcategory		Segment	Manufacturing Process
J	Cold Forming	Cold Rolling	Recirculation: Single Stand
			Recirculation: Multiple Stand
			Combination
			Direct Application: Single Stand
			Direct Application: Multiple Stand
		Cold Worked Pipe and Tube	Water Solutions
			Oil Solutions
K	Alkaline Cleaning	Batch	---
		Continuous	---
L	Hot Coating	Galvanizing, Terne, and Other Metal Coatings	Strip, Sheet, and Miscellaneous Products
			Wire Products and Fasteners
		Fume Scrubbers	---

Table 6-2

Proposed Subcategorization

Subcategory		Segment	Manufacturing Process
A	Cokemaking	By-Product Recovery	---
		Non-Recovery	---
B	Ironmaking	Sintering	Wet Air Pollution Controls
			Dry Air Pollution Controls
		Blast Furnace	---
C	Integrated Steelmaking	---	Basic Oxygen Furnaces Semi-Wet Wet-Suppressed Combustion Wet-Open Combustion
			Ladle Metallurgy
			Vacuum Degassing
			Continuous Casting
D	Integrated and Stand-Alone Hot Forming	Carbon and Alloy Steel	---
		Stainless Steel	---
E	Non-Integrated Steelmaking and Hot Forming	Carbon and Alloy Steel	Electric Arc Furnaces
			Ladle Metallurgy
			Vacuum Degassing
			Continuous Casting
			Hot Forming
		Stainless Steel	Electric Arc Furnaces
			Ladle Metallurgy
			Vacuum Degassing
			Continuous Casting
			Hot Forming

Table 6-2 (Continued)

Subcategory		Segment	Manufacturing Process
F	Steel Finishing	Carbon and Alloy Steel	Hydrochloric Acid Pickling Strip, Sheet Bar, Billet, Rod, Coil Pipe, Tube Plate
			Sulfuric Acid Pickling Strip, Sheet Bar, Billet, Rod, Coil Pipe, Tube Plate
			Acid Regeneration Fume Scrubbers
			Cold Forming Single Stand - Once Through Single Stand - Recirculation Multiple Stand - Once Through Multiple Stand - Recirculation Multiple Stand - Combination
			Continuous Annealing With Water Quench Without Water Quench
			Alkaline Cleaning Sheet, Strip Pipe, Tube
			Hot Coating Galvanizing, Terne, and Other Metals
			Electroplating Sheet, Strip: Tin, Chromium Sheet, Strip: Zinc, Other Metals Plate
			Wet Air Pollution Control Devices Fume Scrubbers

Table 6-2 (Continued)

Subcategory		Segment	Manufacturing Process
F	Steel Finishing (cont.)	Stainless Steel	Acid Pickling and Other Descaling: Strip, Sheet Bar, Billet, Rod, Coil Pipe, Tube Plate
			Acid Regeneration Fume Scrubbers
			Cold Forming Single Stand - Once Through Single Stand - Recirculation Multi Stand - Once Through Multi Stand - Recirculation Multi Stand - Combination
			Continuous Annealing With Water Quench Without Water Quench
			Alkaline Cleaning Sheet, Strip Pipe, Tube
			Wet Air Pollution Control Devices Fume Scrubbers
G	Other Operations	Direct Iron Reduction	---
		Forging	---
		Briquetting	---

Table 6-3

Subcategory Comparison of the 1982 and Proposed Regulations

1982 Regulation	Proposed Regulation	
A. Cokemaking	A. Cokemaking	
B. Sintering	B. Ironmaking	
C. Ironmaking		
D. Steelmaking	C. Integrated Steelmaking	E. Non-Integrated Steelmaking and Hot Forming
E. Vacuum Degassing		
F. Continuous Casting		
G. Hot Forming	D. Integrated and Stand-Alone Hot Forming	
H. Salt Bath Descaling	F. Steel Finishing	
I. Acid Pickling		
J. Cold Forming		
K. Alkaline Cleaning		
L. Hot Coating		
-----	G. Other Operations	